ENGINEERING AND
BOILER HOUSE REVIEW

ESTABLISHED 1899

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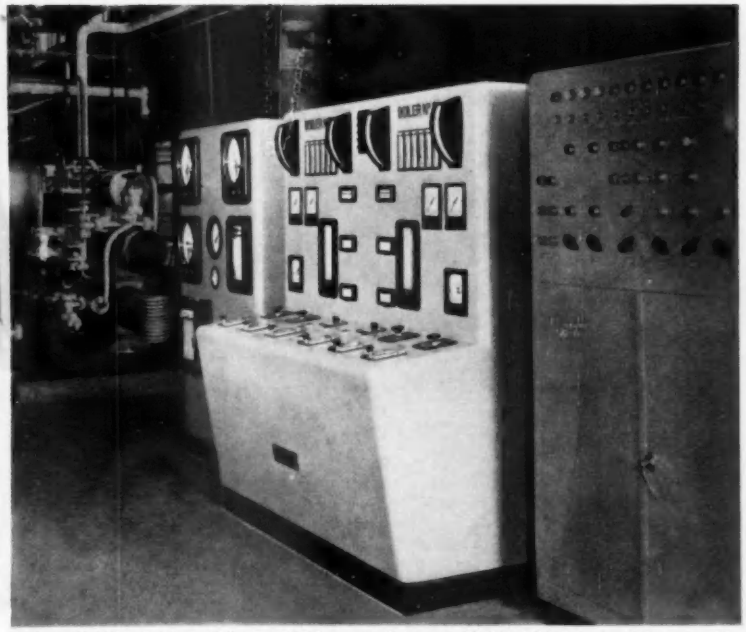
VOL. 74 NO. 3 • THE PIONEER STEAM JOURNAL • MARCH, 1959

Electroflo
Meters & Controls

A TYPICAL 'profit making' INSTALLATION



2—S. & W. W.T. Boilers, oil fired, with Thornycroft burners M.C.R., 28,000 lb./hr., 400 p.s.i.g. @ 700° F. Further particulars on application

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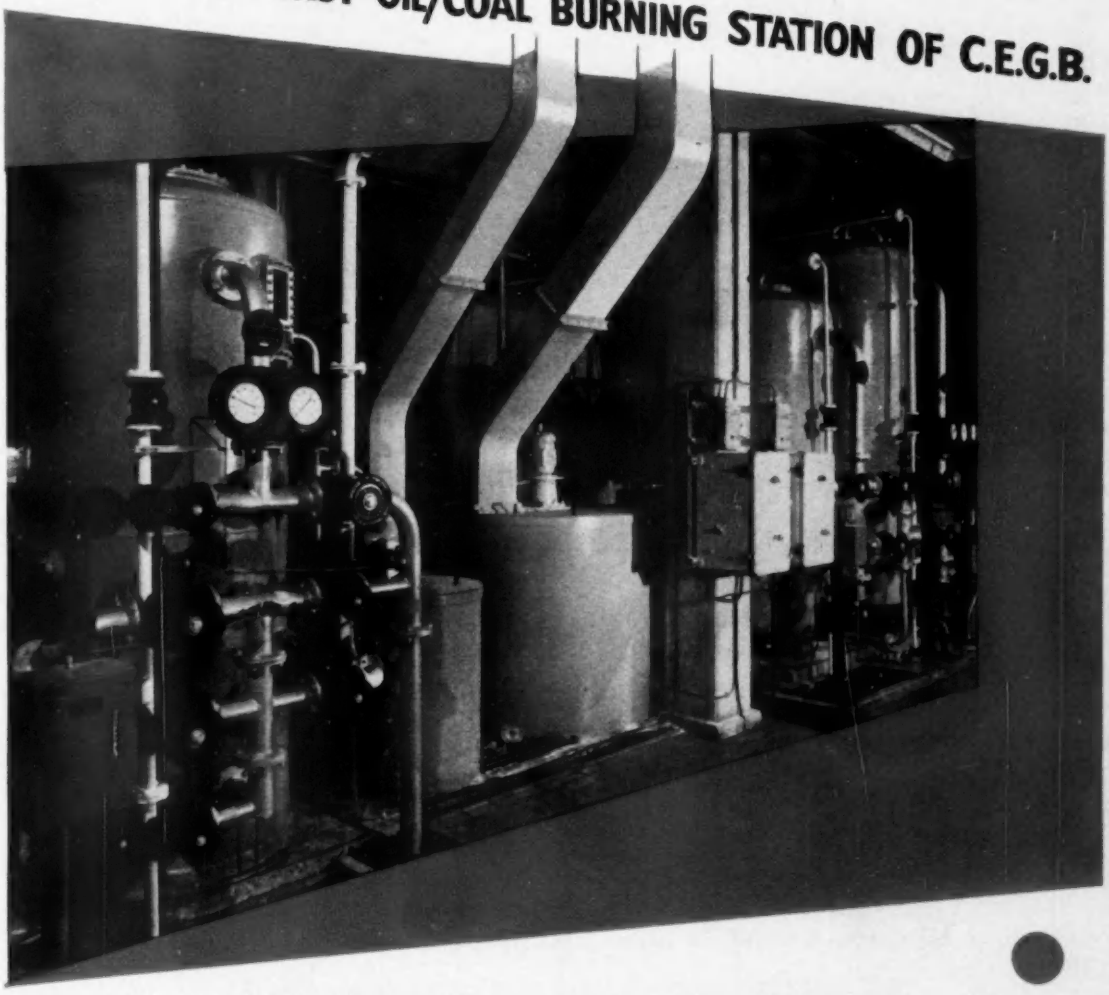

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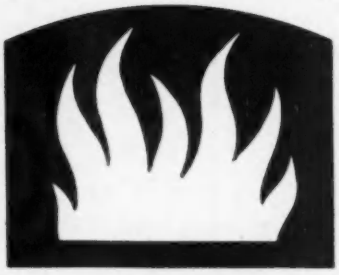

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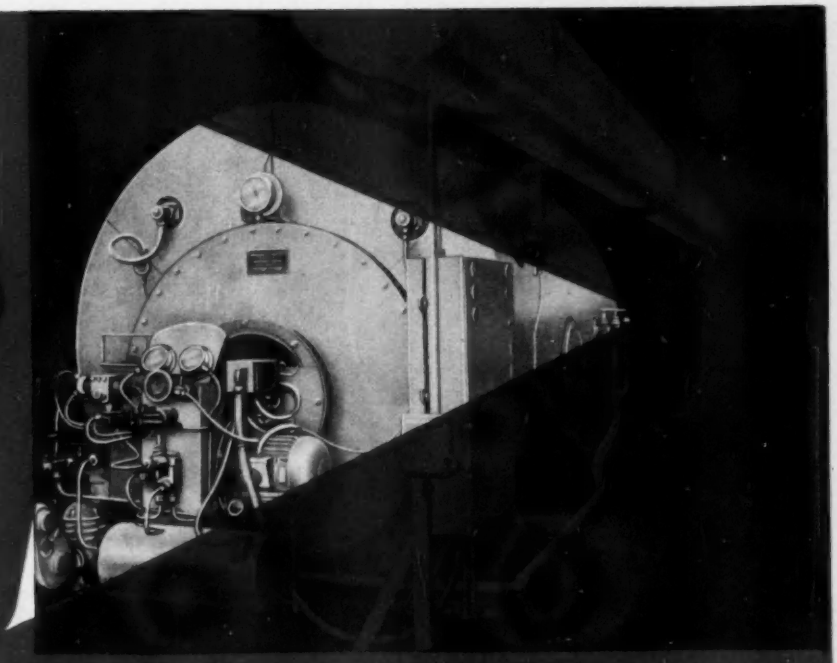

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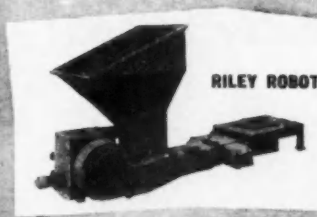

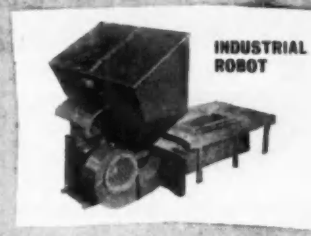

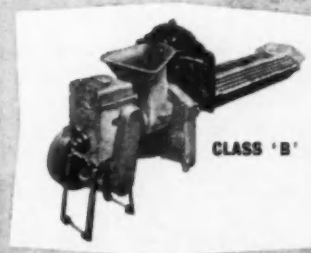

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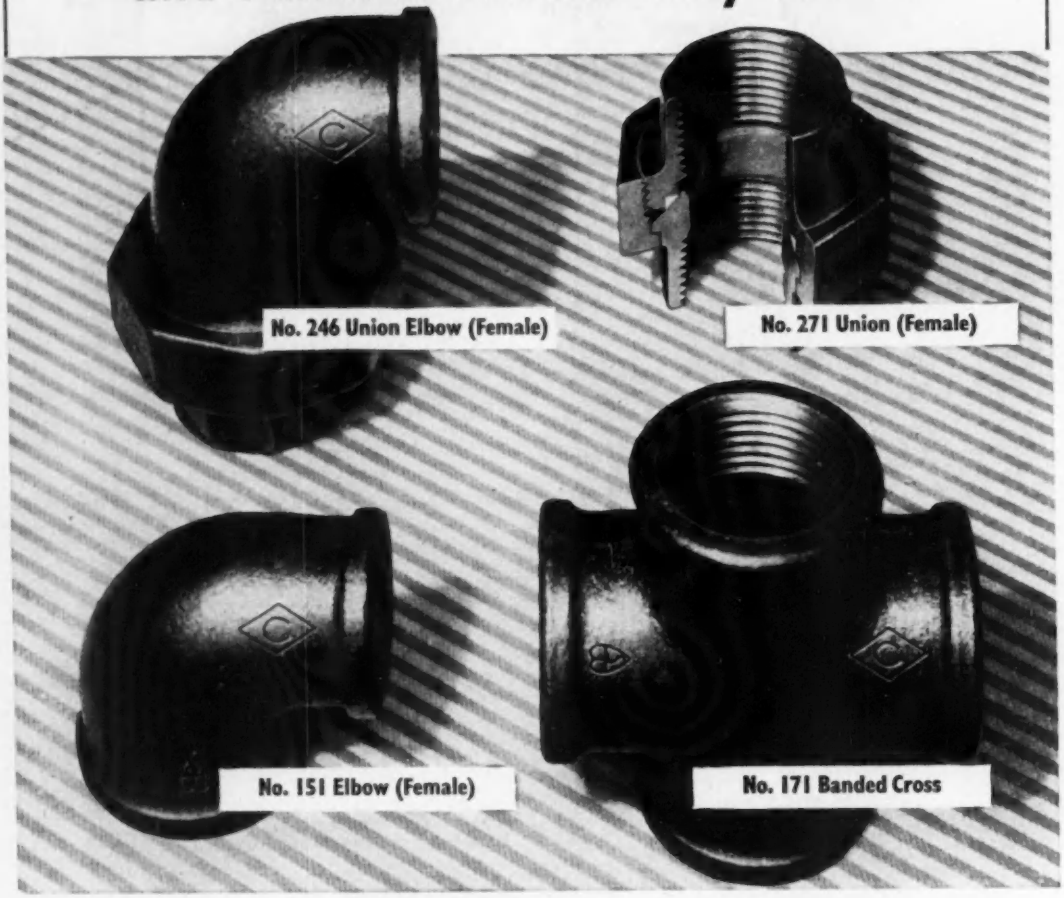

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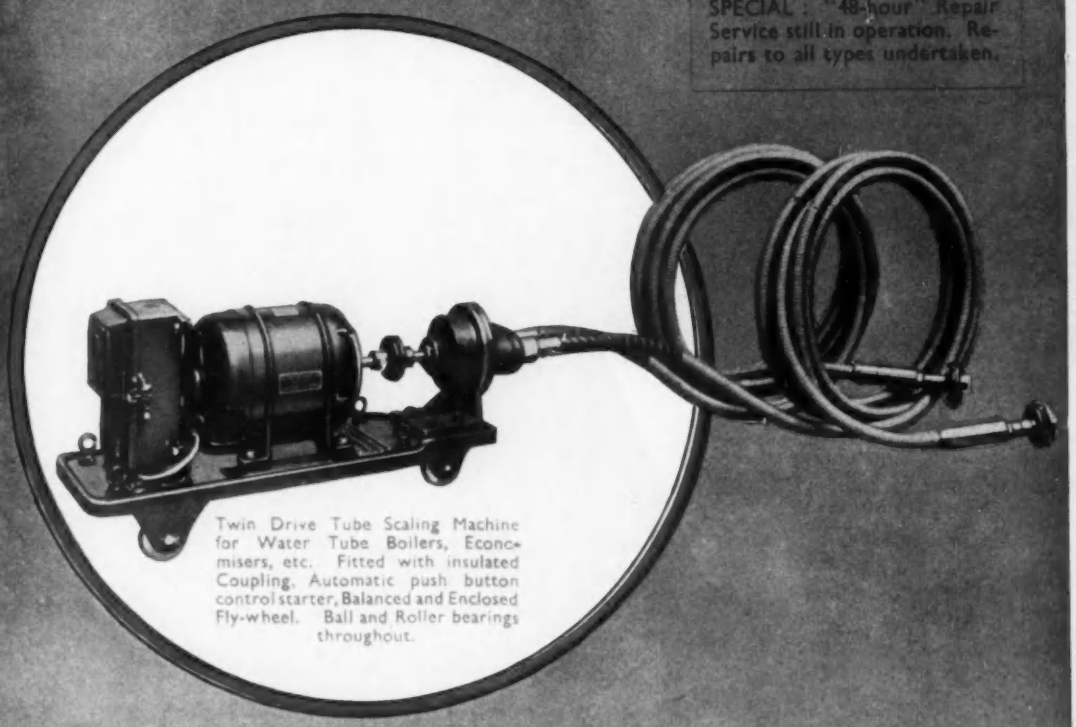

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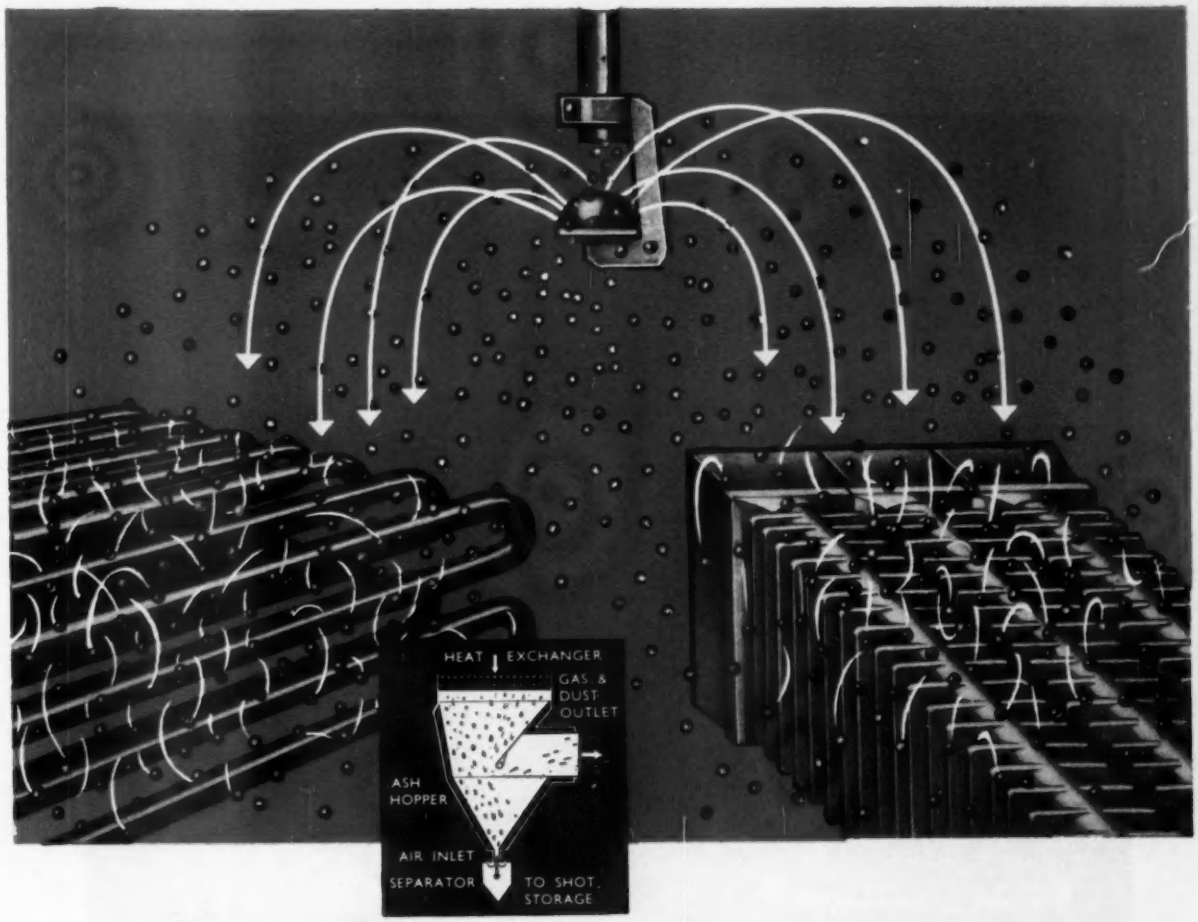

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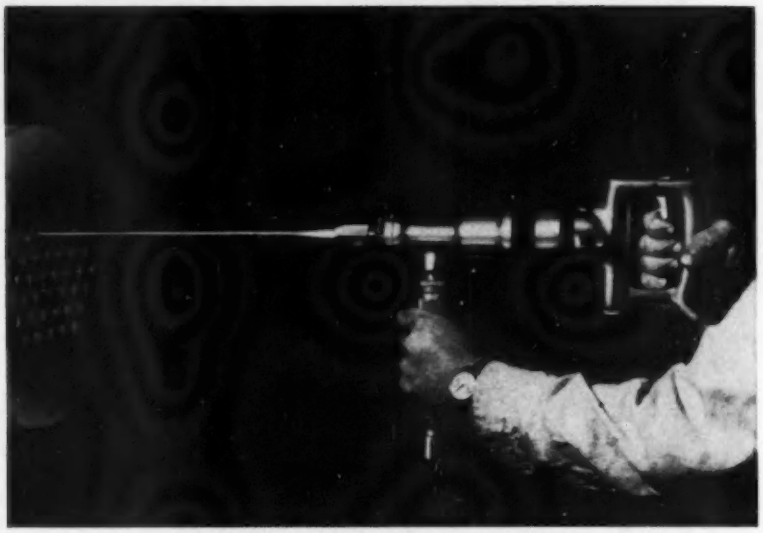

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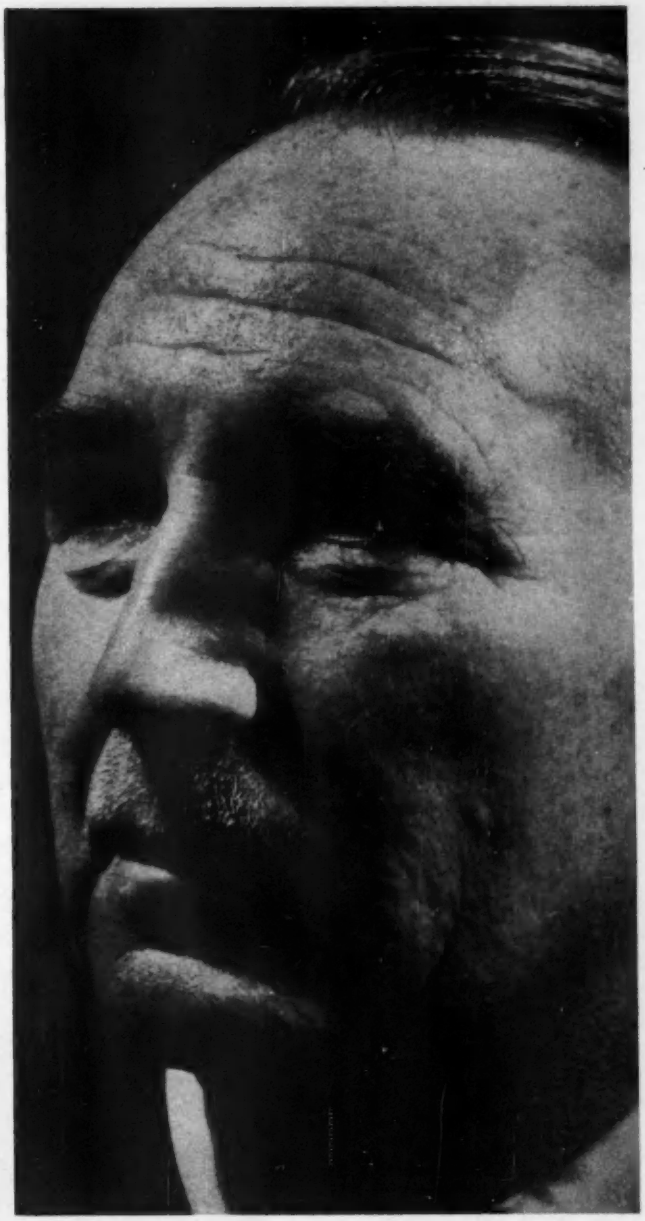

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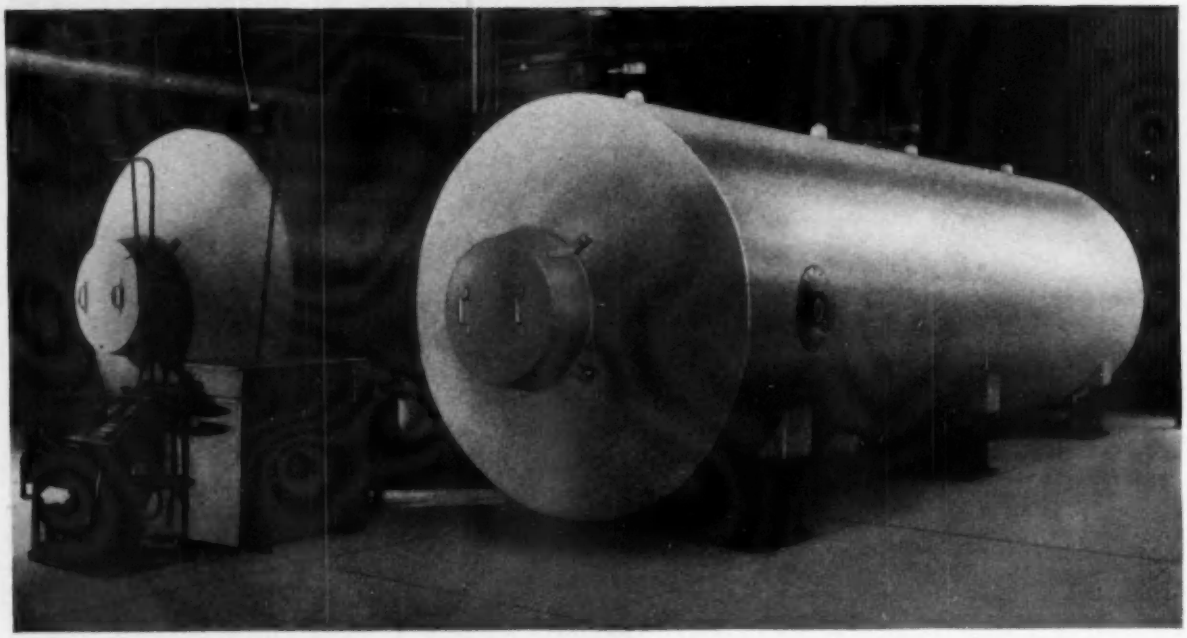

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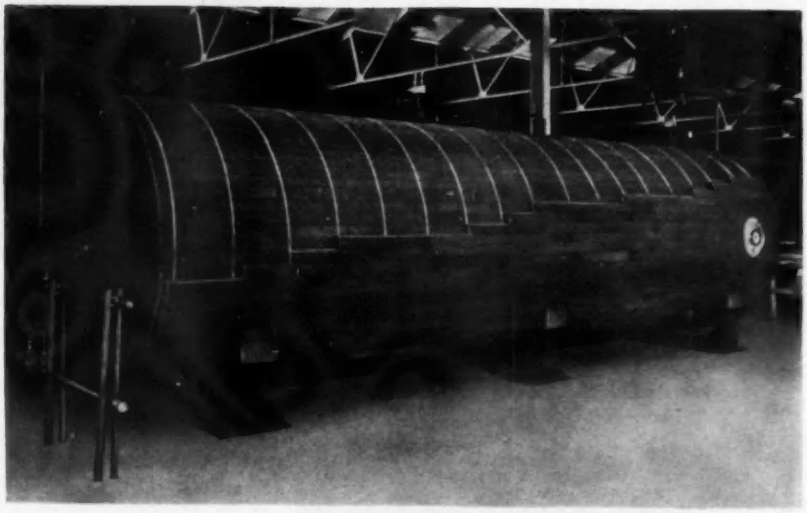

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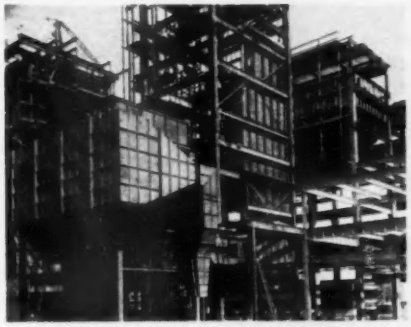
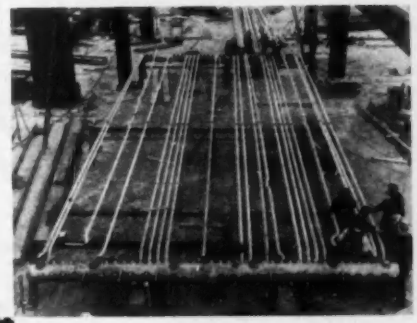
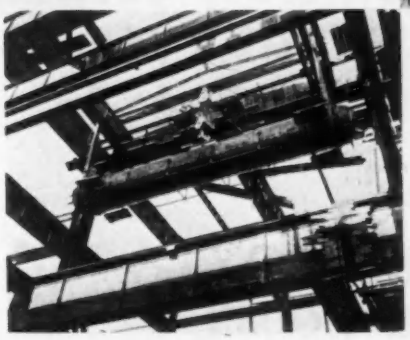


Little Barford B Power Station
"Outdoor installation of 2 boilers."





Aberthaw Power Station
"Panel wall construction on site for one of 6 boilers."

Drakelow Power Station
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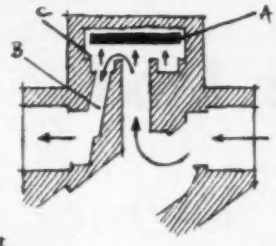
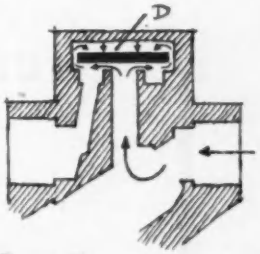
— how it works

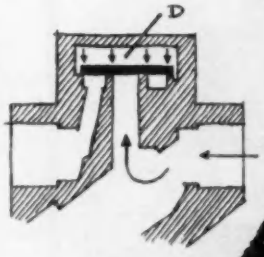


Disc A is raised from seat by incoming pressure, allowing instant discharge of air and condensate through outlet B.



High velocity of following steam creates a low pressure area under disc and builds up pressure in chamber D.

Steam pressure in chamber D exceeds combined force of the incoming steam and the low pressure area. Acting on full top area of the disc, it forces it down and closes the inlet. On no load the valve is thus closed tight.



and how it works!

The Spirax ½ inch 'TD' is all stainless steel with only one moving part. It works in any position, up to 550° F. and without adjustment from 10-350 psi. It has remarkable discharge capacities and is unaffected by superheat, waterhammer, vibration, corrosive condensate and freezing. Full details of this remarkable steam trap in return for the completed request slip below.

Spirax-Sarco Ltd, Cheltenham, Glos.

Please post full details of the new Spirax Thermodynamic Trap.

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EB359

Instrumentation in the boiler house

ensures correct conditions and fuel economy

Temperature . . .

Mercury-in-Glass, Mercury-in-Steel, Electrical; indicating and recording thermometers.

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B2

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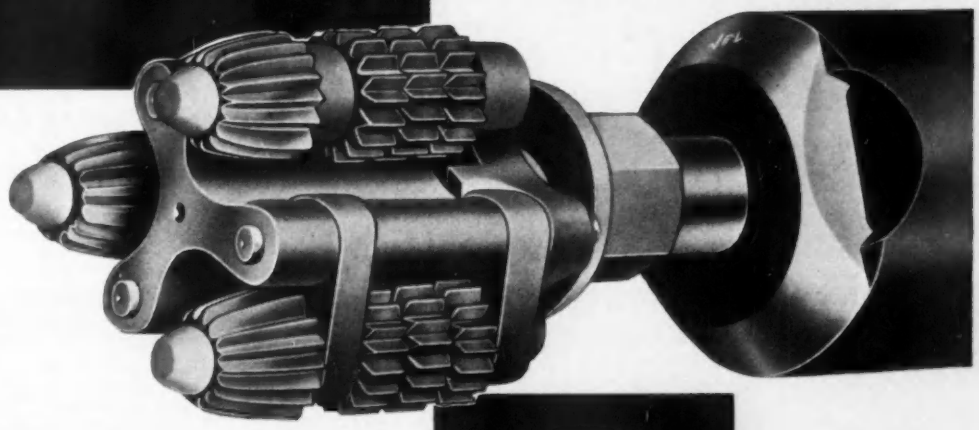
remove the toughest deposit

on any tube cleaning job!

In each swinging arm the long cutting surface of several cutters working together, comprising hundreds of sharp teeth ensure removal of the toughest deposits in straight or curved tubes.

Note, in the diagram, the wide swing of the cutter arms of the Lagonda swing-frame head—wider than in any other swing-frame head—giving plenty of latitude for any possible variation in the I.D. of the tube.

Of course a head like this takes a lot of drive to get the best out of it. This is where the powerful Lagonda motors come in, with double ball thrust bearings and full lubrication that let practically all the power through to the cutter head. The full range of Lagonda tube cleaners caters for all types of deposits in tubes straight or curved, from ½" dia. upwards. Write for Catalogue Y-48.



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TUBE CLEANERS

made by Consolidated Pneumatic

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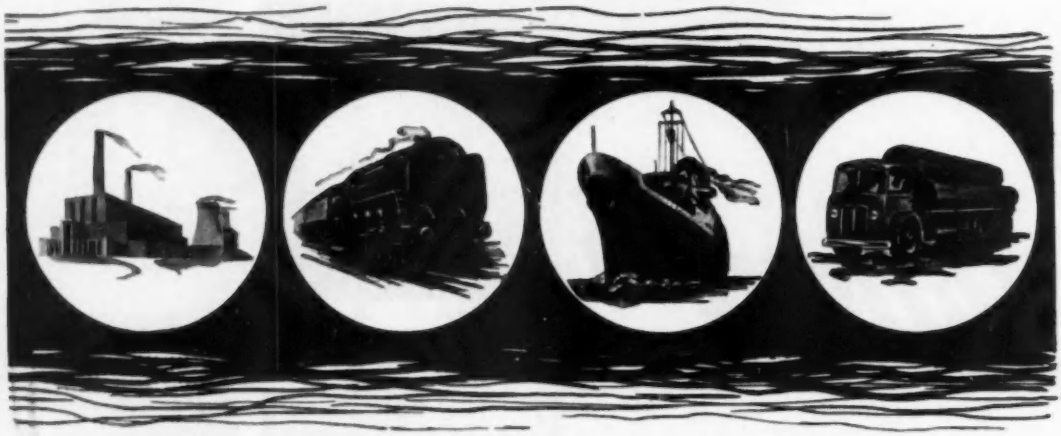

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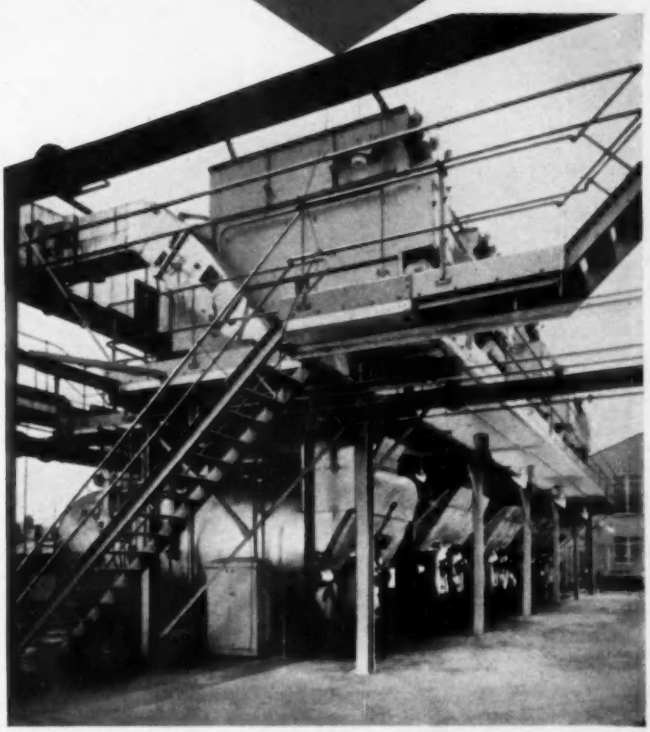
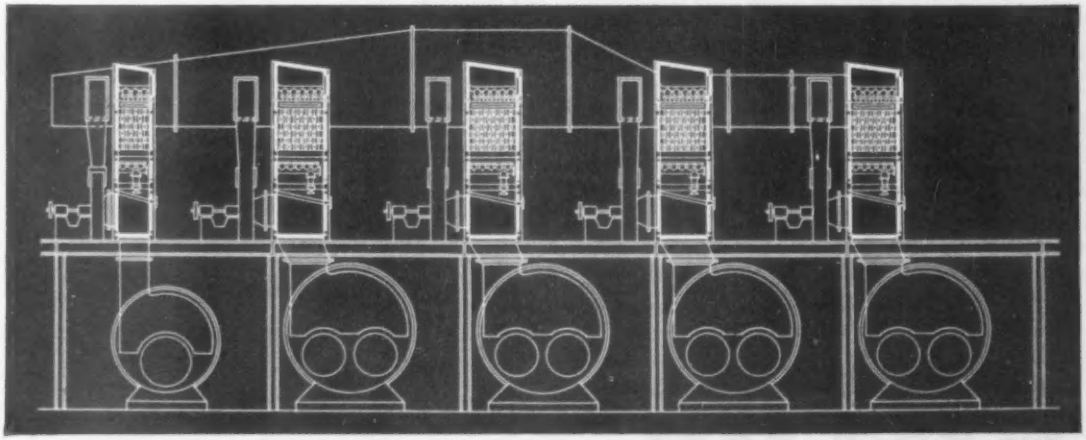
GREEN'S ECONOMISERS

with ECONOMIC BOILERS at I.C.I. SLOUGH

The Paints Division of Imperial Chemical Industries Limited of Slough operates an outdoor boiler plant, consisting of five John Thompson Economic boilers, four of 13,000 lb/hr each and one of 7,000 lb/hr. oil-fired, designed working pressure 120 p.s.i. Mounted above each boiler is a Green's Premier Type D. Economiser, the general arrangement being as shown below.



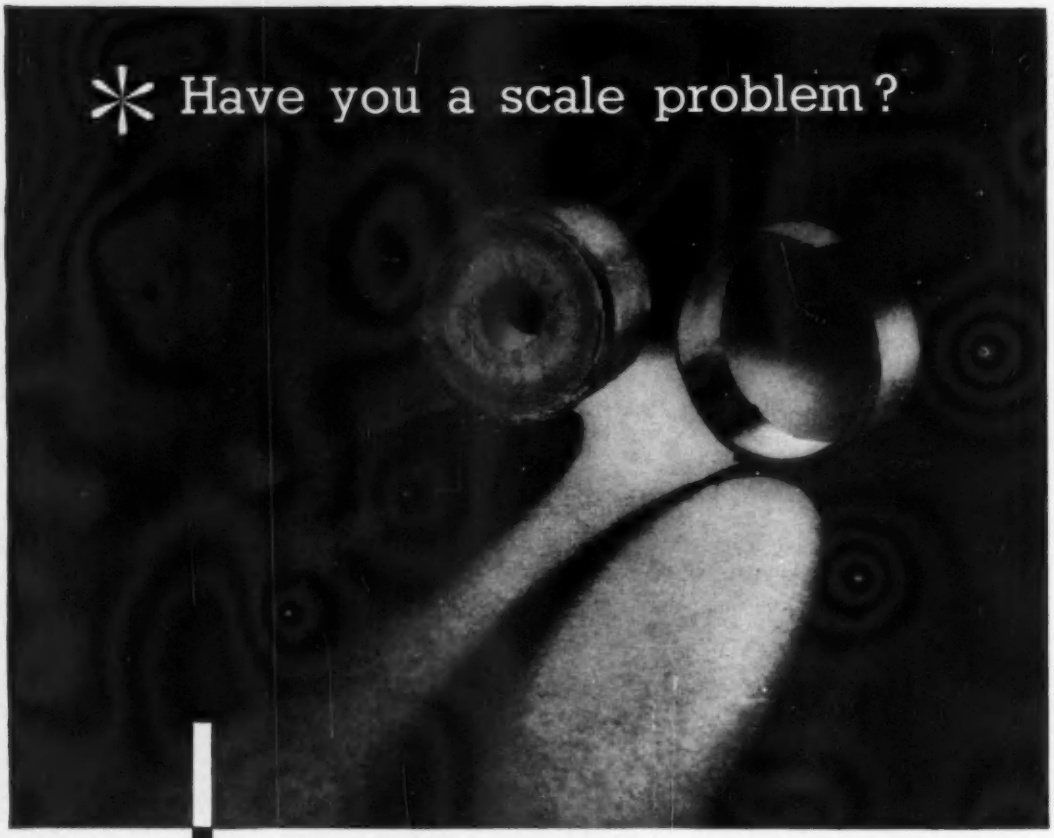


E. GREEN & SON LTD · WAKEFIELD

Makers of economisers for more than one hundred years

GE.203

* Have you a scale problem?



This dramatic illustration, an actual photograph of two pieces of copper piping cut from the same length, shows, on the left, how scale deposit restricts flow and consequent heat transfer and, on the right, how Starit treatment removes the obstructing matter, leaving the surface of the pipe unimpaired.

Scale deposits impose stresses in the metal and seriously reduce the heat transfer efficiency so vital for economical steam raising.
Starit solution effectively removes most types of scale from boilers, feed pipes, heat exchangers, cooling systems and similar apparatus, cleaning those awkward corners beyond manual reach and leaving the metal in a first-class conducting state. The unique formulation of Starit ensures rapid attack on the scale whilst its action on the boiler plate is inhibited.

As there are certain rare cases where the scale is not susceptible to chemical attack, we invite you to send us a sample of scale, so that we can determine whether Starit should be used. We will also supply on request a booklet dealing with the application and limitation of Starit and the methods of using it.

STARIT TRADE MARK

STARIT

STARIT LIMITED
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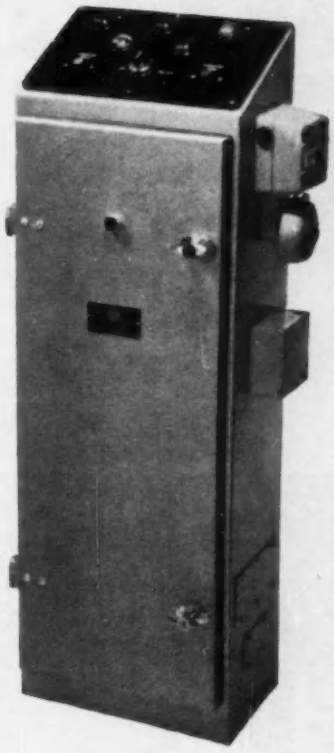
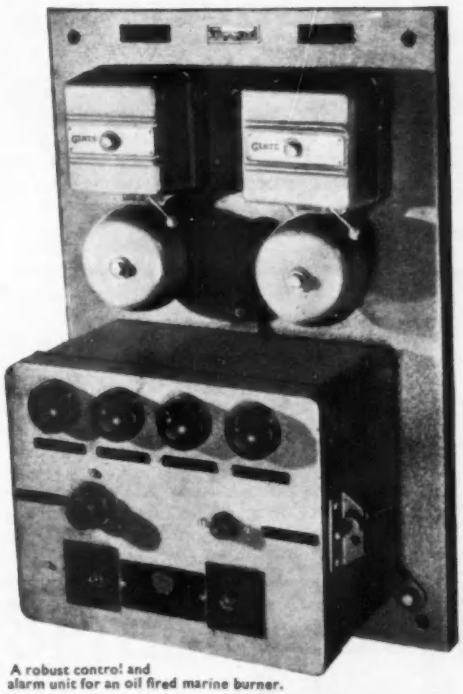
S4

BURNER CONTROL PANELS



A pedestal control unit with built-in alarm, and desk-type signal and control panel.



A robust control and alarm unit for an oil fired marine burner.

To provide safe lighting-up procedure for any type of gas or oil-fired burner, more is required than merely a flame-failure relay and a solenoid valve.

As pioneers in flame failure and lighting-up techniques over the last ten years, ELCONTROL are increasingly being asked to supply complete burner control panels embodying a suitable flame control unit, completely foolproof lighting-up sequence and other accessories as appropriate.

These panels provide a completely pre-wired proprietary burner control unit and save users a great deal of trouble and expense, not only in devising suitable control schemes, but also in assembling and wiring up the complete control systems.

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ELCONTROL LTD.
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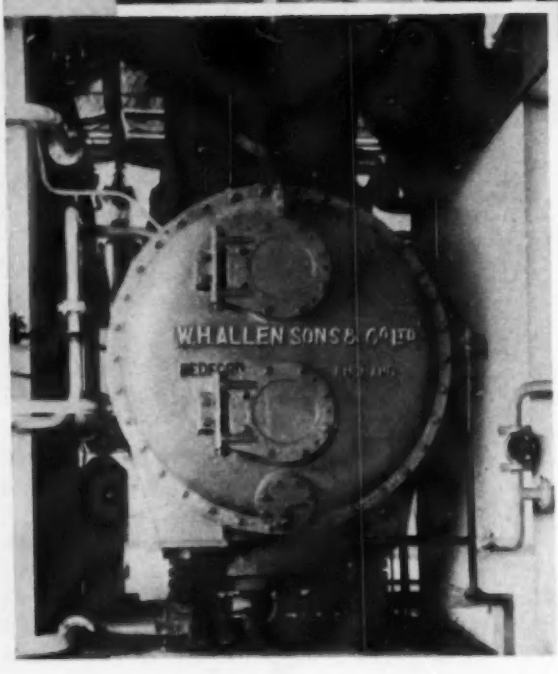
ALLEN TURBINE PLANT



ULAN POWER STATION

of the

ELECTRICITY COMMISSION of NEW SOUTH WALES

The new Ulan power station, which supplies electricity for the Ulan County Council distribution area and surplus energy to the grid, is equipped with two ALLEN steam turbines and associated plant, shown in the illustrations.

Each set comprises a single-cylinder, multi-stage condensing turbine driving through speed-reduction gears, a totally enclosed water-cooled Mather & Platt alternator, designed for a continuous full-load output of 3,125 kW at 11,000 volts, 0.8 power factor, 3 phase, 50 cycles, running at a speed of 1,500 r.p.m.

The turbines, which run at 5,000 r.p.m. and operate on steam at 400 p.s.i.g. and 750 deg. F., have two bled steam points, the first providing steam for an evaporator, and the second connected to a feed heater to raise the condensate temperature on return to the feed-water system.

Consulting Engineers: Donoghue & Carter, Sydney

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W. H. ALLEN SONS & Co LTD

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H for economy . . .

H means fuel economy in hundreds of boiler installations, because it symbolises the design principle on which the success of the Senior H-tube Economiser depends. The practical expression of this principle takes the form of heat-exchange tubes with vertical cast iron H-shaped gill units assembled in such a way that:

(a) The heating surface is fully swept with maximum efficiency by the flue gases.

(b) The gas passages are straight, vertical and of uniform area.

As a result draught losses remain consistently low and efficiency consistently high throughout a long trouble-free life.

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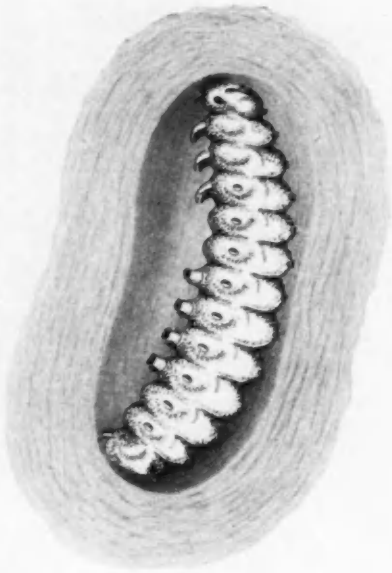
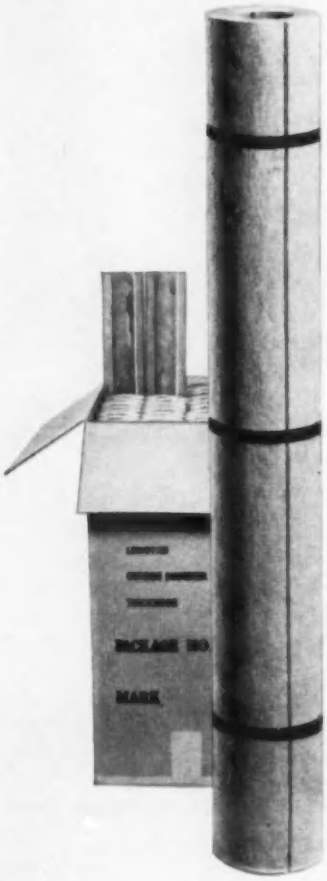
smaller scale insulation jobs



ROCKSIL rigid pipe sections made to fit your problem



Rocksil rigid pipe sections are manufactured from long-fibred rock wool bonded with resins. Light but strong, robust and easily fitted—an inexpensive answer to the problem of efficient insulation in the lower and medium temperature ranges.

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HEAT CONSERVATION: Hot water lines; Low pressure steam lines up to 600° F; Steam traced oil lines.
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Canvas or scrim wrapped, with or without bands.
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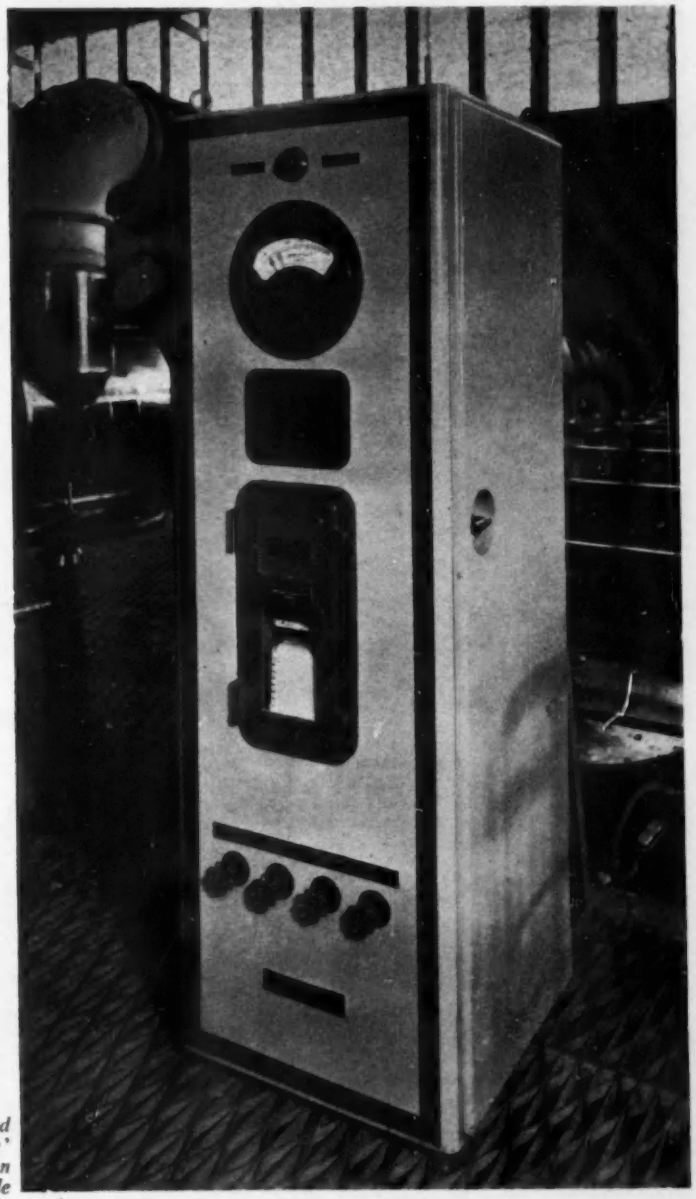

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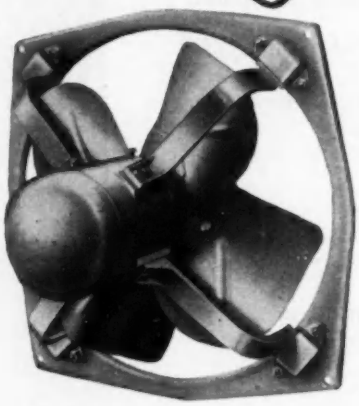
costs less in the long run



The quality of engineering in WOODS propeller fans means lasting reliability and economy from long service. Remember, WOODS are the world's most widely used fans, chosen internationally for performance and quality.

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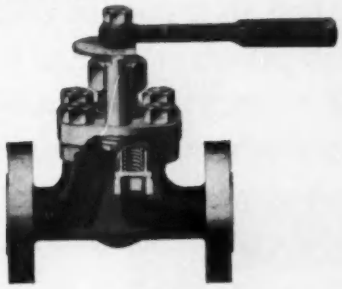

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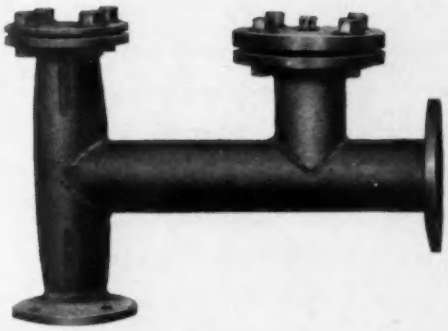

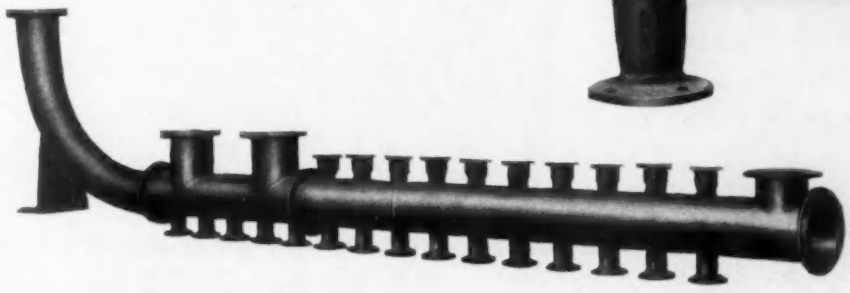

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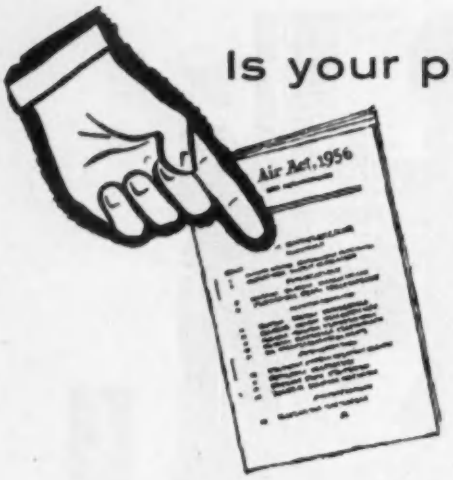

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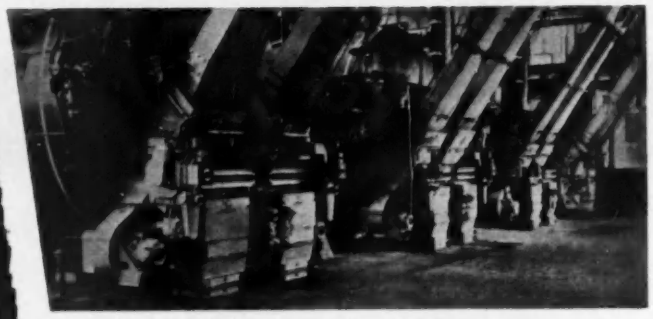
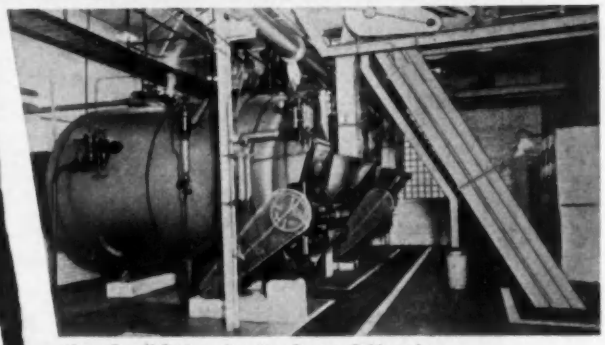


Bennis Chain Grate Stokers fitted to Economic boilers.



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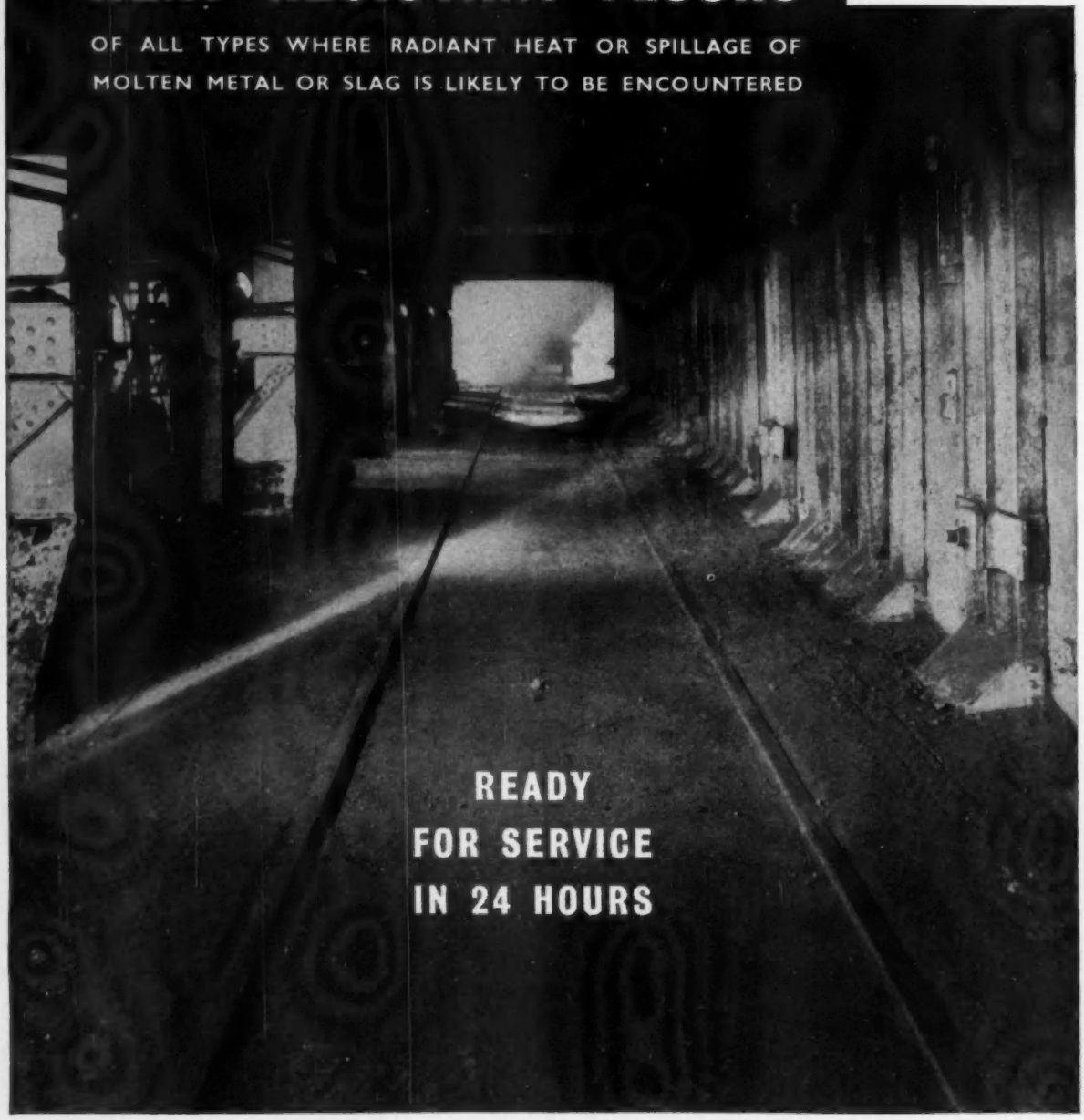

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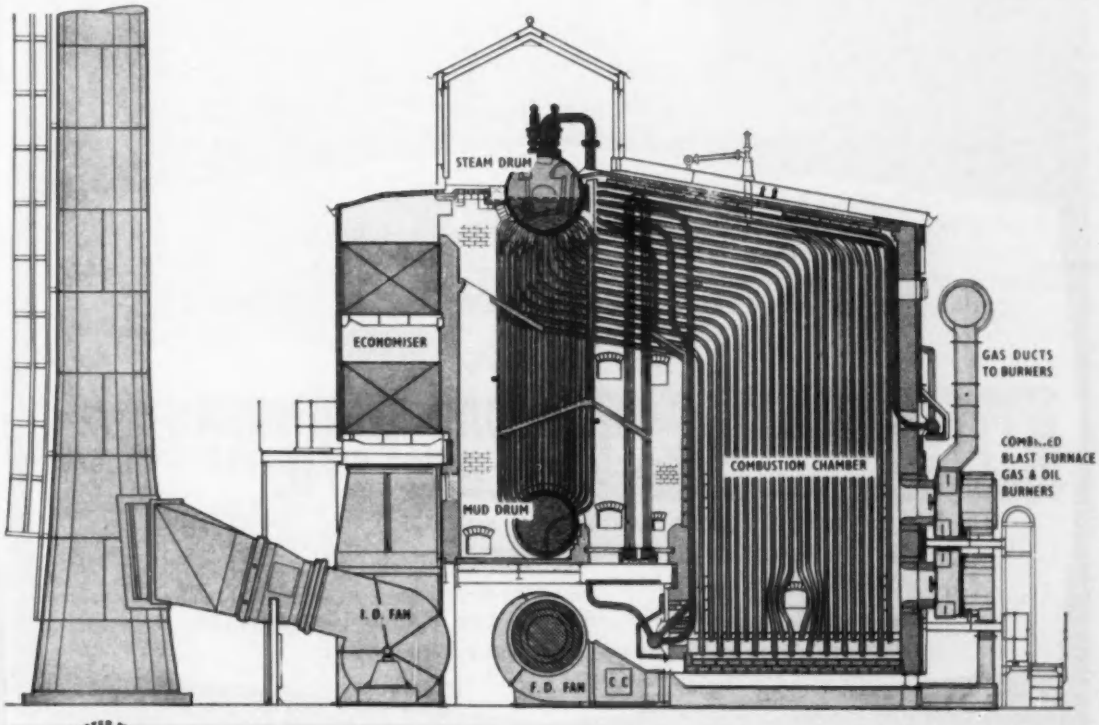
AP 3/74

JOHN THOMPSON 'INTEGRAL'

WATER TUBE BOILERS

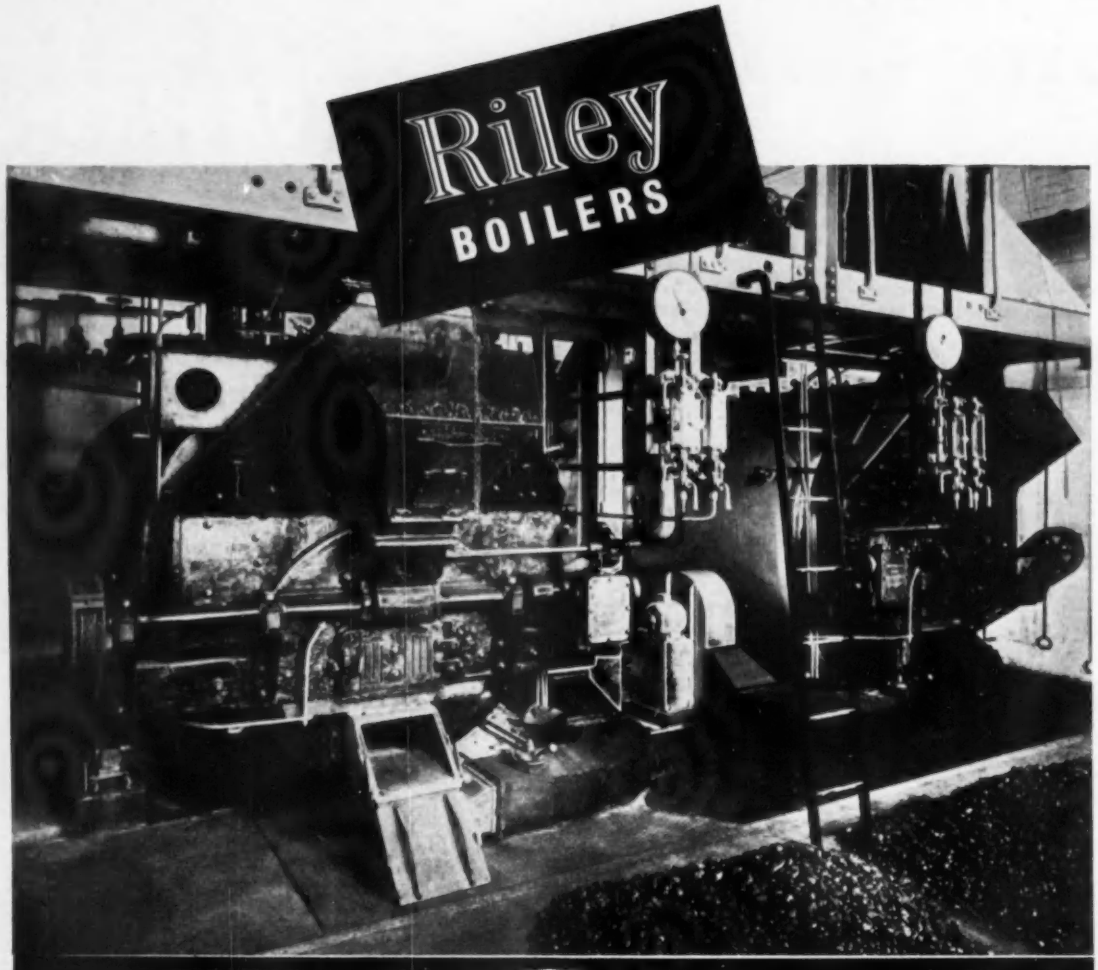
The John Thompson 'Integral' boiler is basically a two drum water tube unit which can be supplied for solid, liquid or gas firing. Water walls are used and these reduce brickwork maintenance and cut radiation losses, whilst providing flexibility and rapid response to increased steam demands. The combustion chamber design is such that low heat release rates are attained with relatively small furnace areas. Particular care has been given to circulation and a system of internal baffles is arranged to give high steam purity. Adequate water storage capacity is ensured by the large single bank of tubes and its associated downcomers together with the water walls and their independent feeding circuits. The installation at Stewarts and Lloyds consists of two John Thompson 'Integral' boilers each with an M.C.R. of 50,000 lb./hr. on blast furnace gas or 75,000 lb./hr. on oil firing. The working pressure is 450 lb./sq. in., and final steam temperature 750°F. Steam generated is used for turbo-alternators and turbo-blowers and extraction steam for works processes and space heating. John Thompson have long experience in manufacturing all types of boiler plant and are able to advise on the most suitable equipment for specific requirements.

Below is shown the arrangement of a John Thompson 'Integral' boiler fired by blast furnace gas or oil at Messrs. Stewarts and Lloyds, Bilston. Above, one of the boilers is seen during erection.



JOHN THOMPSON GROUP

JOHN THOMPSON WATER TUBE BOILERS LIMITED · WOLVERHAMPTON



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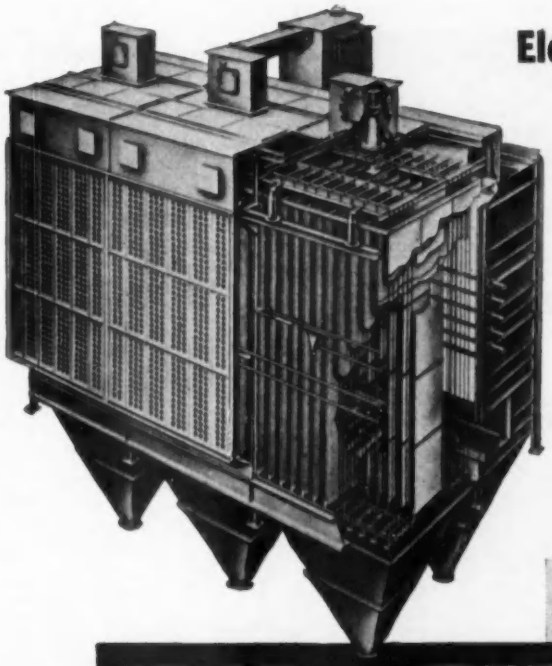
VERTICAL, LANCASHIRE, MARINE AND WASTE HEAT BOILERS, STEEL CHIMNEYS, VESSELS AND TANKS



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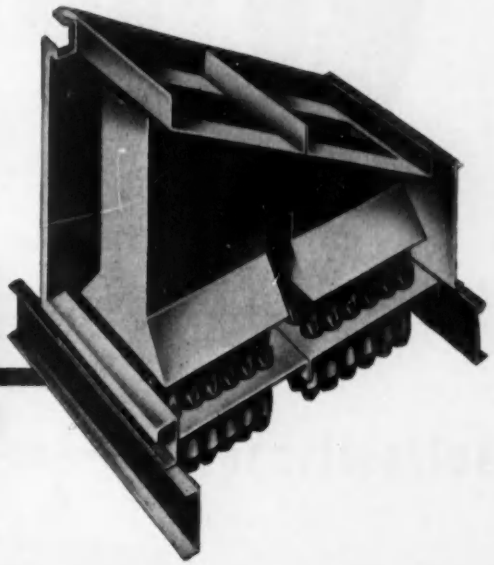
Made under licence from the Aerotec Corpn., U.S.A., these precipitators have an extremely high collection efficiency, low current consumption and many novel design features including screen-grid type collecting electrodes which minimise re-entrainment and consequent emission of dust. Manufactured in several combinations of width, height and length to suit available space in existing plants or most efficient usage of building volume in new constructions.



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Here is a dust collector which satisfies the ideal requirements of steam generator designers. It has a high collection efficiency at moderate resistance; maximum freedom from dust erosion; accessibility for maintenance and service; simple, low cost erection; flexibility of arrangement to meet space availability conditions. These collectors can be used in series with electrostatic precipitators and can be designed to match the precipitator inlet.

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The product of over 75 years of experience, 'Tornado' induced and forced draught fans can handle any boiler draught requirements efficiently and reliably. The type A.R. aerofoil section backward bladed centrifugal fan, with peak efficiency of 90%, is only one of the many types (another is the combined induced draught and grit arrester) produced to deal with all classes of boilers from central heating to those in the largest power stations.

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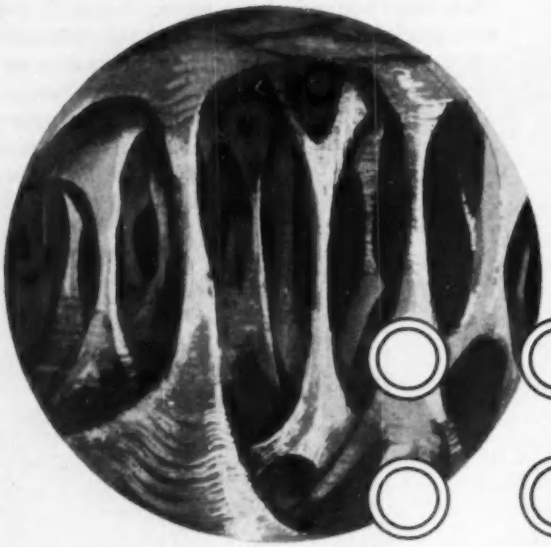

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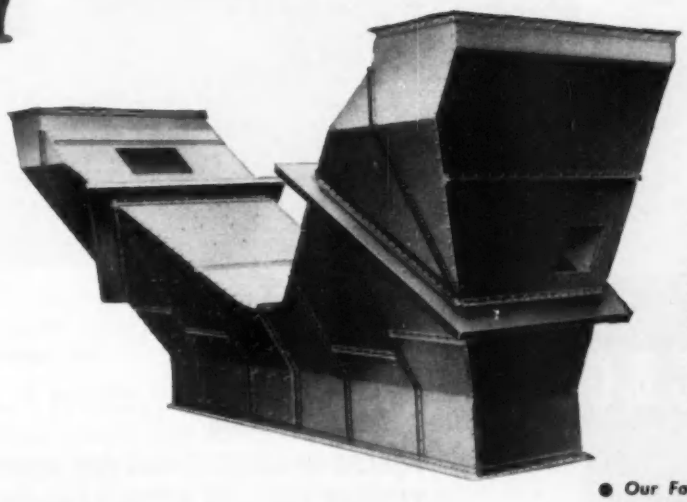

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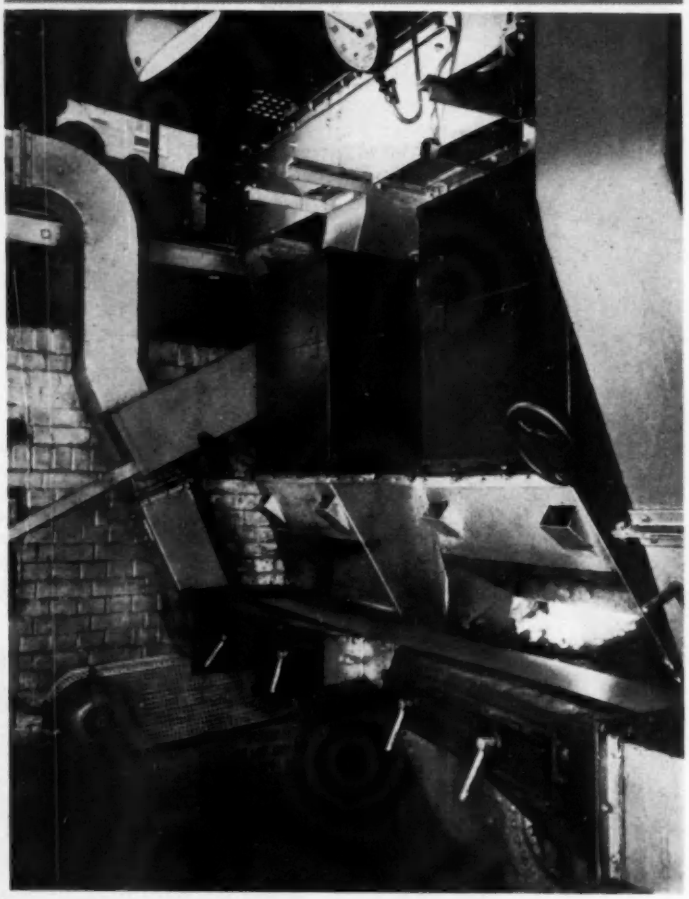

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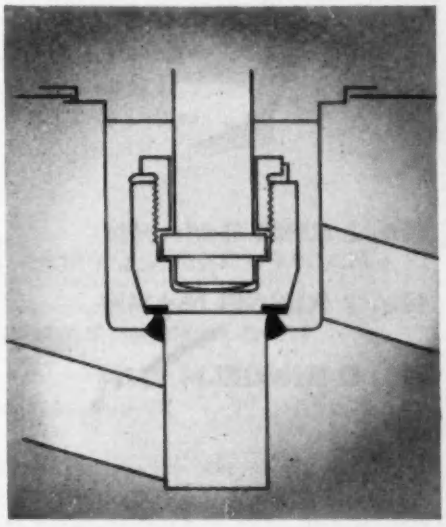

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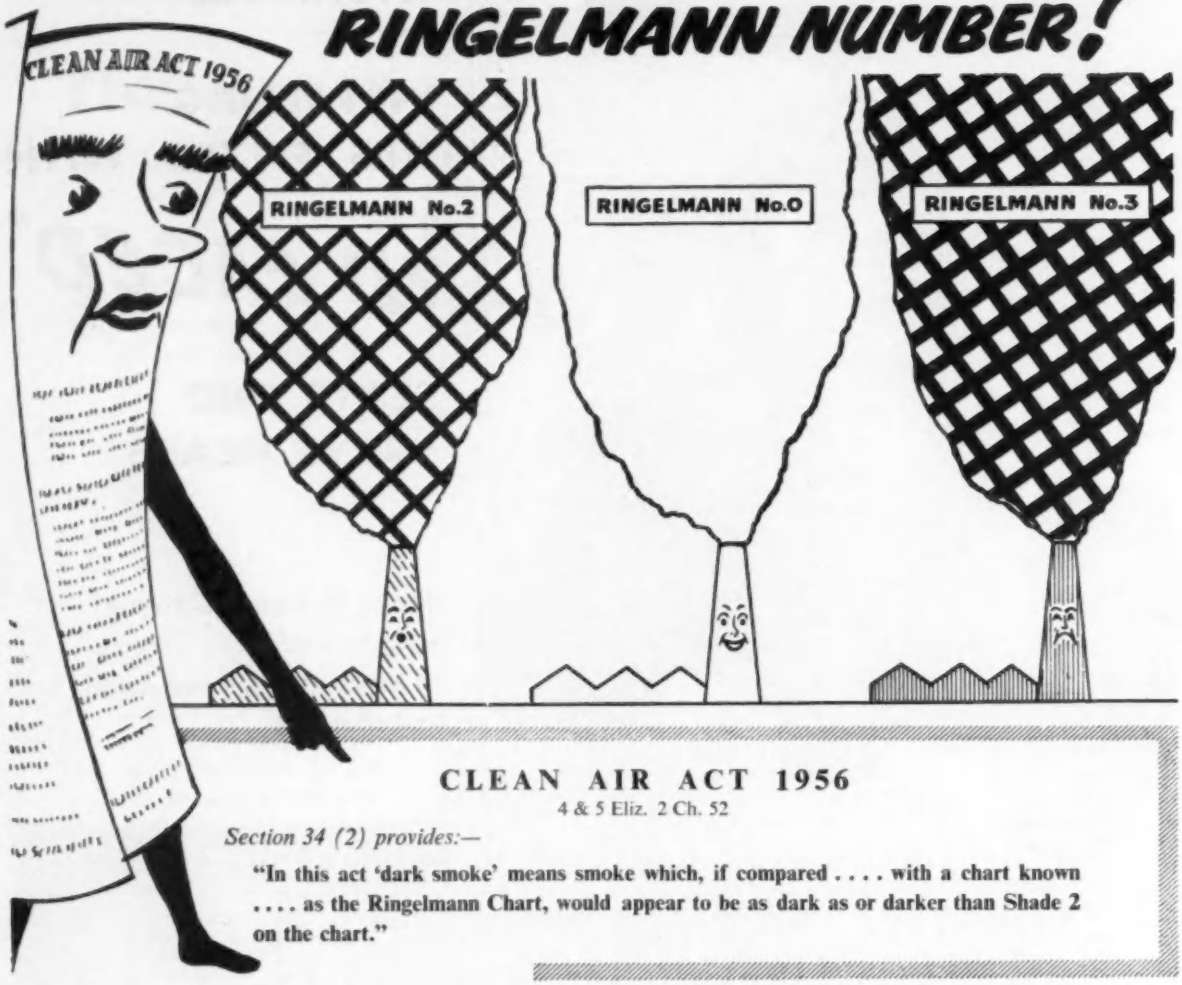

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Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

MARCH 1959

VOLUME 74. No. 3

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The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable

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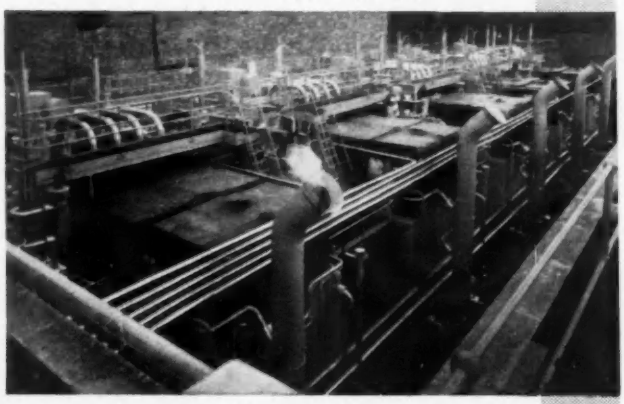
The five boilers, each rated at 36,000 lb./hr. M.C.R., at 425 lb./sq.in., 680°F, are of the "outdoor" type, with only the firing-aisle, control equipment and auxiliaries under cover, so eliminating the capital cost of a boiler-house. Oil-firing is by means of 'Y-jet' wide-range steam-atomizing burners, of which there are 3 per boiler, using 3,000-seconds fuel-oil.

The whole of the fuel-oil pumping-and-heating plant and most of the high and low pressure pipework also were designed, manufactured and installed by Babcock & Wilcox.

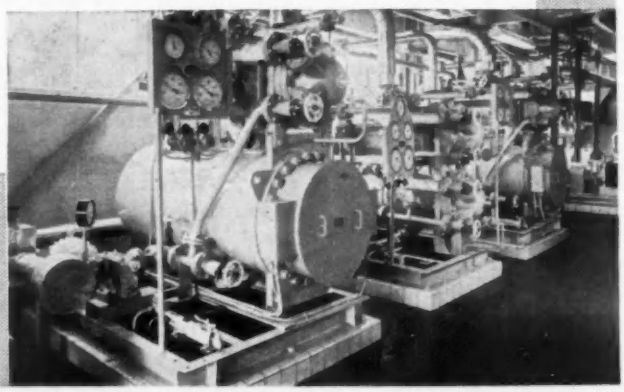
This boiler plant replaces a previous Babcock installation which had served this factory well for over 40 years.

(Consulting Engineers: Merz & McLellan).



(Above) The "outdoor" installation of five Babcock Bi-drum boilers.

(Below) Babcock fuel-oil pumping and heating units in the pump-bay serving the boiler plant.



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Engineering and BOILER HOUSE REVIEW

MARCH 1959

VOLUME 74 No. 3

NATIONALISING THE ENGINEERING INDUSTRY

ARGUMENTS continue to be put forward between the Engineering Trade Unions and the Labour Party, and the T.U.C. for further measures of nationalisation or State ownership of various sections of the engineering industry—particularly the heavy engineering industries, the aircraft and machine tool industries, the manufacture of coal mining machinery, firms engaged upon the manufacture and repair of railway wagons, and the steel industry. For some six or seven years now, discussions have been proceeding between representatives of the Confederation of Shipbuilding and Engineering Unions (comprising 39 unions) and Transport House chiefs as to the extent of State ownership which should be applied to engineering. In due course the Labour Party drew up a plan in its policy statement " Challenge to Britain " for partial nationalisation of some sections of the engineering industry. This plan was duly submitted to the Party Conference as far back as October, 1953. It has always been a basic assumption of socialists in the policy of nationalisation that public ownership and control are a guarantee of efficient service in the public interest, and that without a wide measure of public control of certain sections of the engineering industry, it is impossible to maintain permanently a stable and expanding economy. In practice, however, not only has the performance of, at any rate some of, the nationalised industries fallen far short of their authors' promises and expectations, but public control, which is the ostensible purpose of public ownership, has been all but derisory. Nationalisation is still believed to be a panacea, and whatever is wrong with industry in private hands can be put right by bringing it under public control. But actually, nationalisation has not proved that panacea for all ills which the workers, if not their leaders, supposed it to be. It has created at least as many new problems in, for example, labour relations, as it has solved, and has not necessarily led to improved and efficient working conditions or to greater security.

Undoubtedly, one of the main objects of nationalising the engineering industry, or at least the main sections thereof, is to increase the influence of the trade unions in the management of those sections of the engineering industry concerned. A wide variety of reasons continue to be put forward for imposing some form of national control. For example, it has more than once been suggested that if any section of the engineering industry has an almost complete dependence upon the State or State Agencies for its business and finance, it should be nationalised outright. In formulating this particular reason, it has not been realised that governmental agencies are not only " not always right," but can be quite frequently wrong; and that, therefore, even the limited freedom of the large and private engineering firms to expend their full resources and to possibly take risks in developing their own particular form of design and production, may well prove as valuable in the future as it has in the past. It is sometimes forgotten that the engineering industry is, as a whole, largely made up of comparatively small size firms, many of which are just as efficient as the larger ones. It is difficult to see how nationalisation would improve their prospects, or even maintain their efficiency.

A booklet entitled " Report on Nationalisation," and published by the Federation of British Industries toward the end of 1958, deals at considerable length with the various arguments for nationalisation. The booklet points out that a programme of nationalisation may be examined at two levels. First, there is its effect on the individual industries selected for the take-over ; secondly there is its effect on the working of the economic system as a whole. The system of free enterprise has shown, both in this country and in many others, that it provides high and rising standards of living at all levels. Free enterprise is an efficient system, because it provides individuals with the incentive to seek progress through more efficient ways of doing things; at the same time it subjects them to the pressures of competition from others who seek the same end. In the result there is every chance of the consumer getting the things he chooses—not those that some authority thinks he ought to have—and he gets them in ever-increasing quantities. The greater the restriction of ownership of property the less is the opportunity for encouraging the sense of individual self-reliance without which the free society cannot endure.

Points and Pointers

BRITISH ELECTRICAL POWER CONVENTION

"Electricity and Its Contribution to the Standard of Living" is to be the theme of the eleventh British Electrical Power Convention which is to be held in Torquay from June 1st to 5th next, under the presidency of Mr. C. R. King, C.B.E., Comp.I.E.E., M.Inst.F., deputy chairman, Central Electricity Generating Board. As in former years, there will be an electrical exhibition associated with the convention. Although the exhibition will not be officially opened by the president until the evening of Monday, June 1st, it will be open to delegates all day. The convention sessions will be held in the Pavilion and will open on the morning of Tuesday, June 2nd, when Mr. King will give his presidential address. According to the preliminary programme a paper on "Progress on the First Nuclear Power Stations—Bradwell, Berkeley, Hinkley Point, Hunterston," will be given on Tuesday morning by Mr. F. H. S. Brown, B.Sc.(Hons.), M.I.Mech.E., M.I.E.E., member of the Central Electricity Generating Board, and Mr. J. Henderson, M.C., B.Sc., A.R.T.C., M.I.E.E., chief engineer, South of Scotland Electricity Board. On Wednesday morning Mr. A. N. Irens, M.Sc.(Eng.), M.I.E.E., chairman, South Western Electricity Board, will present a paper on the subject of industrial, commercial and domestic electrical progress. There will be two papers in the afternoon session—one by a representative of the Electrical Contractors' Association, dealing with electrical contracting in all its aspects, and one by a representative of the National Inspection Council for Electrical Installation Contractors on all aspects of safety in the home. Mr. O. W. Humphreys, C.B.E., B.Sc., M.I.E.E., F.Inst.F., research director, General Electric Co. Ltd., will give a paper, with demonstrations, on "The Development of Light Sources."

EXPERIMENTAL REACTOR OF ZERO POWER

A new low-power research reactor, known as "HERO" (Hot Experimental Reactor of Zero Power) is to be built at the United Kingdom Atomic Energy Authority's Windscale site, which is being expanded as one of the national centres for the development of gas-cooled reactors. "HERO" will be built near the Advanced Gas Cooled Reactor (A.G.R.), work upon which has already begun. The function of "HERO" will be complementary to that of A.G.R. It will be recalled that A.G.R. is essentially a reactor for fuel element development under reactor working conditions; it is designed to work at power levels corresponding to 100,000 kW of heat (30,000 kW electrical). "HERO" will facilitate the making of measurements at low radiation levels and will enable experiments to be made with several alternative arrangements of fuel elements to obtain optimum results. "HERO," which will generate a few kilowatts of heat, will consist initially of a graphite structure 19-ft. in diameter and 19-ft. high, but an important provision is that it will be possible to dismantle and rebuild it in a variety of ways. The graphite core will be contained in a steel vessel connected to a ventilating circuit with pumps and heaters, so that it can be operated at high temperature in carbon dioxide. It will, in fact, be the reverse of the A.G.R., since the carbon dioxide gas will supply heat to the core instead of removing heat from it. As in A.G.R., the fuel will consist of clusters of rods of uranium oxide sealed into beryllium cans, and these will be arranged in channels in the graphite on a regular lattice. It is estimated that "HERO" will be completed in 1961, at a cost of about £1,250,000.

LONGER-TERM D.S.I.R. GRANTS

It is announced that longer-term grants for special researches will be awarded by the Department of Scientific and Industrial Research in future. These grants—which have normally been limited to a maximum of five years—may now be awarded for an initial period of up to seven years with the possibility of continuing support for a further 10 years. The first closing date for applications is March 1st. This change in policy has been made to meet present-day needs. The more complex and expensive researches may require support for more than five years to become fully established. When fully established the support for these researches will be transferred from D.S.I.R. to university research; arrangements are being worked out to simplify such transfer. The department is therefore willing to support for longer periods outstanding university investigators embarking on promising researches for which their universities are unable to make adequate provision. The main conditions are: An initial award for periods of three to seven years, with the possibility of two renewals, each of a maximum duration of five years. A third renewal would not normally be given. Details of the scheme are contained in the 1959 edition of "Notes on D.S.I.R. Grants," published by H.M. Stationery Office recently.

FARADAY LECTURE ON "AUTOMATION"

The Faraday Lecture of the Institution of Electrical Engineers was given at the Royal Festival Hall, London, a few weeks ago, by Dr. H. A. Thomas, manager, Instrumentation and Control Section of the Engineering Department of the Technical Branch of Unilever Limited, on the subject of "Automation." A distinction was drawn at the outset of the lecture between mechanisation as an aid to human muscles, and devices which assist the senses and the brain, although it was shown that all are linked by a continuing process which carried us from the first to what may be considered the second industrial revolution. The lecture showed how measurements with delicate apparatus may be amplified so as to be shown on large recording instruments, and so introduced the idea of feedback from such

a system to correct deviations from a standard. Demonstrations illustrated how this principle may be applied first, to finite, and then to continuously varying deviations, so that the stage is reached where corrections are applied far more rapidly than would be possible by a human operator acting on signals from instruments. The operation of an electronic digital computer was illustrated with demonstrations of how a problem in simple addition can be fed into it in punched tape form, and how the information is manipulated to obtain the result. The principles of a computer " memory " were conveyed by models and film, leading to a survey of the functions of computers in industry and commerce, both in the direct control of plant and in the provision of data for the guidance of management which could not be obtained in other ways. The lecture concluded by emphasising the opportunities offered by these techniques in an increasingly competitive world, where Britain is now no higher than eighth in the scale of incomes per head of population, and urged that entry from school and college into science and engineering should be undertaken with the same spirit that inspired the Merchant Venturers of the first Elizabethan age.

UNITED KINGDOM/EURATOM ATOMIC ENERGY AGREEMENT

The United Kingdom/Euratom Atomic Energy Agreement, the text of which was recently published as a White Paper (Cmnd 649, H.M. Stationery Office, 9d.), contains provisions for the exchange of information between the United Kingdom Atomic Energy Authority and the Euratom Commission, including the licensing and sub-licensing of patents. The agreement is intended to provide the necessary framework for practical co-operation on the peaceful uses of atomic energy between institutions and individual industrial concerns in the United Kingdom and in the Euratom countries. Thus, it will open the Euratom market to reactors developed in Great Britain, and will help users in Euratom countries to gain experience in the field of natural uranium reactor technology. The Authority and the Commission are to assist persons within the Euratom Community and in the United Kingdom in obtaining research and power reactors and other material and equipment necessary for atomic energy programmes, and are to help them in obtaining assistance in the design, construction and operation of such reactors and of fuel manufacturing and processing plant. Arrangements are laid down for the supply by the Authority to the supply agency of the Community, or to other persons duly authorised by the Euratom Commission, of the necessary fuel for reactors obtained from the United Kingdom and for its processing after use. It is provided that the contracting parties shall co-operate in providing adequate financial protection against third party liability, and it is envisaged that the Atomic Energy Authority and the Euratom Commission may assist each other through the secondment of experts and in other ways. We note that there is an undertaking whereby material and equipment obtained under the agreement shall be used for peaceful purposes only. Moreover, the continuation of the co-operation envisaged in the agreement shall be contingent upon the mutually satisfactory application to such material and equipment (when it is within the European Atomic Energy Community) of the security control established under the provisions of the Euratom Treaty and (when it is within the United Kingdom) of the measures for accounting for the use of material and equipment established by H.M. Government. Consultation and exchanges of visits are to take place to implement this provision. The agreement also provides for periodical meetings of representatives of the contracting parties to consult on matters arising out of the application of the agreement, to supervise its operation, and to discuss the possibility of additional arrangements for co-operation. Discussions have taken place recently between the members of the Commission and members of H.M. Government on the establishment of permanent machinery for this purpose. It appears that a standing committee is to be established forthwith at the technical level, and the parties agreed to consider further the question of establishing a supervisory body which would include members of the Commission on the one side and members of H.M. Government and of the Atomic Energy Authority on the other.

COAL VERSUS OIL

Sir Ian Horobin, Parliamentary Secretary, Ministry of Power, told the Commons, during a recent debate on fuel and power policy, that discussions were proceeding between the Central Electricity Generating Board, the National Coal Board and the oil companies, to see if it was possible, within the framework of existing contracts, to postpone the conversion from coal to oil-firing of the boilers at two more power stations in 1959, as a gesture by the oil companies to the nationalised coal industry, in view of its present difficulties. If it was found to be practicable, the Generating Board would require approximately one million tons of coal more than was planned under the conversion programme. As to whether the Government should embark on a policy of deliberately switching the economic demands for fuel for the benefit of one of the competing providers of power, the answer, said Sir Ian Horobin, was " a firm and definite ' No.' " It was the consumer who should have the choice. It would be to the national advantage to have as cheap fuel as possible. Anything that could be done to reduce the price of coal or oil was a good thing, but the Government did not think that anything less than keen competition would be likely to achieve that. It was certainly not the intention of the Government to increase the price of oil by putting a tax on it and hoping that in some mysterious way this would reduce the price of coal. The member who opened the debate had asked that at least four of the power stations now in the process of being converted to oil-firing should be put back to coal-firing. He said that the boilers in the four stations already converted were burning oil of a coal equivalent of 2.38 million tons a year. It had been estimated that the consumption at stations converted to oil would be the equivalent of 8 million tons in 1965. Mr. Alfred Robens, winding up for the Opposition, said his Party did not object to competition between the fuel industries, but to the present unfair competition between coal and oil. No one had said that the conversion from coal to oil was dictated by competition or commercial motives; it was dictated by the shortage of coal at the time. Unless a power station was on an estuary where oil could be unloaded easily, it was doubtful whether oil for any power station in the country would show any advantage over coal on a purely price basis.

150-MW Power Station for Hong Kong

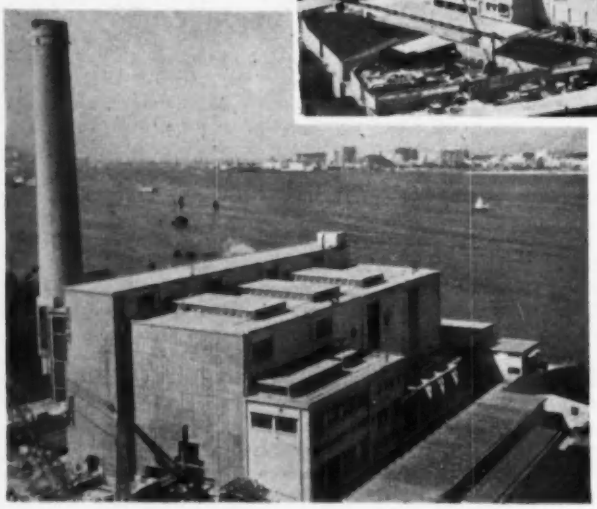
IMMEDIATELY after the 1939-45 war, the Hong Kong Electric Company Ltd. (which was founded in 1925) realised that their existing power station, the installed capacity in which had been repeatedly increased during the years preceding the war, had become totally inadequate to meet the rapidly-increasing electrical load demands in the colony. It was obvious that the modern trend towards rebuilding numerous sections of Hong Kong would call for the construction of ultra-modern blocks of offices within the city itself, and a very comprehensive housing construction programme on the outskirts.

In order to deal with the electrical load problem, the management of the Hong Kong Electric Company called in the English Electric Company to act in collaboration with George Wimpey & Co. Ltd., as joint main contractors, for the design and construction of a new generating station at North Point—to be known as North Point "B" power station, and to be erected alongside the existing "A" station.

The English Electric Company's General Engineering Projects Department, in London, undertook the responsibility for the design, co-ordination and erection and commissioning of the station. During the preliminary discussions it was envisaged that the new plant would have an ultimate total generating capacity of 180-MW from six 30-MW generating units. A revision to the available site area, however, necessitated a re-arrangement of the station and layout design to give an ultimate total generating capacity of 150-MW from five 30-MW sets.

In the first phase, the construction and installation of plant was limited to half the ultimate station building, together with one generating unit, one boiler, and all normal station auxiliaries. Since the commencement of the work, two further stages of the construction have been released to the English Electric Company—comprising the second and third generating sets with their respective boilers, together with the completion of the station buildings. The whole of the station civil design and construction work was put in the hands of George Wimpey & Co. by the English Electric Co. The completion date of the first phase was scheduled for January 1st, 1959, but the first unit was, in fact, commissioned on October 20th, 1958 and went on to commercial load on October 21st, 1958. The station was officially opened by the chairman of The Hong Kong Electric Co.—Mr. Brian T. Flanagan—on Monday, December 15th, 1958.

The centre-lines of the new station are parallel to the old station and located so as to cause a minimum of re-routing of existing roads, under which ran services connected with the "A" station. The completion of the "B" station involved the removal of existing stores, workshops and the administration block, some of which have been rebuilt by George Wimpey & Co. on new land acquired by the Hong Kong Electric Company on the west boundary of the old compound area.

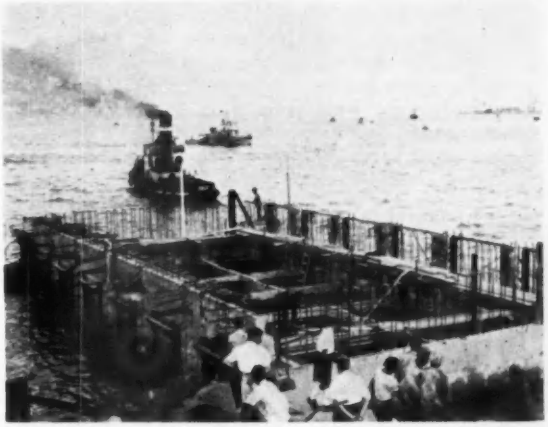


Two aerial views showing the first stage of North Point "B" power station, Hong Kong. The upper view shows its close proximity to the existing "A" station, whilst the lower view is across the harbour, looking towards Kowloon.

The ground upon which the new station was built is on land reclaimed from the sea and, as such, comprises rock and rubble fill founded upon rock which slopes up from an approximate depth of 90-ft. below ground surface at the north-end to an outcrop of rock at the south-end. Included in the filled area are at least two old sea walls, one of which runs practically down the centre line of the turbine house. Owing to the depth of some of the foundation work, and to the fact that the sea level rises from +2.00 to +8.00 it was necessary to sink a deep pumping well in the turbine house to keep the excavations dry.

Building and civil engineering work

The station has been designed on modern lines, there being no dividing wall between the boiler and turbine rooms, thus increasing natural light and ease of operation and maintenance. The turbine foundations are in the form of a reinforced-concrete raft supported by reinforced-concrete piles which found upon the natural rock—the building columns being supported on reinforced-concrete caps which rest on group piles. In all, some 760 reinforced-concrete piles approximately 80-ft. long are used to carry the foundation of the main buildings and of the two 200-ft.-high reinforced-concrete chimneys. It was established that before any piles could be driven, shafts would have to be sunk at each pile group to remove boulders, some of which were found to weigh from 5 to 10 tons each.



The sub-base of the circulating-water pump house after being floated across the harbour from Whampoa Dockyard where it was constructed.

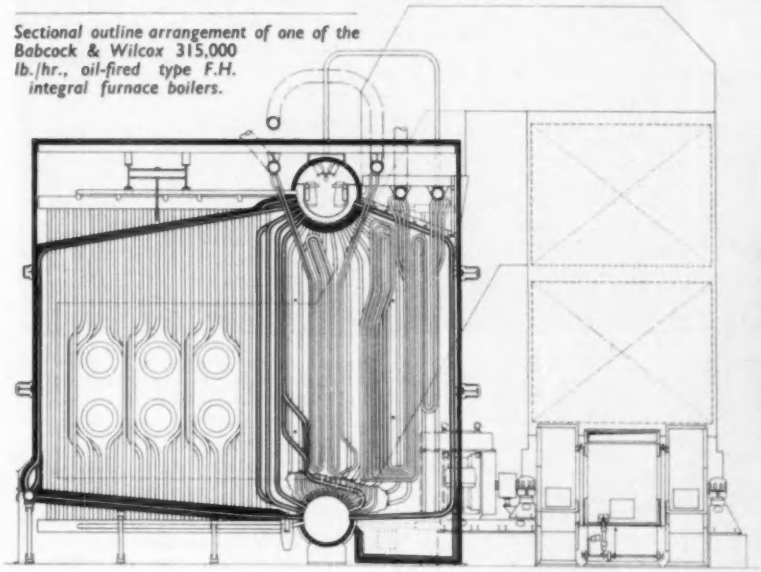
The main building is a steel-framed structure with brick walls, reinforced-concrete floors and steel decked roof covered with a concrete screed and waterproof felting. The walls are supported by reinforced-concrete bund walls or ground beams spanning between column foundations.

Twin inlet and outlet reinforced-concrete circulating-water culverts, pressurised on the inlet side, are located below basement floor-level, and run parallel with the turbine house centre-line. Due to the nature of the ground, the circulating-water pump house was of the caisson type construction, the sub-base and side walls being built on a slipway at the Kowloon Docks in reinforced-concrete, and launched when calculations showed sufficient freeboard to enable the structure to float.

It was then towed across the harbour to a wharf beside the power station, and further pours of concrete to raise the walls were made until the whole was drawing 19-ft. of water. At this stage the structure was sunk onto previously prepared foundations and construction completed in the normal way. At the time of launching, the structure weighed 400 tons, but this had increased in weight to 1,400 tons when finally sunk into position. The circulating-water inlets are incorporated in the circulating-water pumphouse structure. For the completed station there will be two chimneys, each arranged to receive the gases from three boilers. These chimneys are being constructed by Tileman & Co. Ltd., London, The control room is on the east side of the turbine house and is equipped with air conditioning. On the west side of the boiler house there is a canteen for the Chinese employees. All buildings have been designed to meet typhoon conditions.

The first stage of the project is, so far as civil engineering and foundation work are concerned, virtually completed, and the second-stage ground work is proceeding according to schedule. The main building is being extended, together with the circulating-water

Sectional outline arrangement of one of the Babcock & Wilcox 315,000 lb./hr., oil-fired type F.H. integral furnace boilers.



Off-loading one of the boiler drums at Hong Kong, after shipment from the Babcock & Wilcox works at Renfrew, Scotland.

culverts, southward some 230-ft. from the first-stage portion of the station. As in the first stage, the foundation work is being aggravated by the presence of the two old sea-walls—and furthermore, the boiler house extension is being built over the site of a stores building. This building was erected on about 500 timber piles, 30-ft. to 40-ft. long, quite a number of which fouled the position of the new Vibro piles—of which there will be approximately 360.

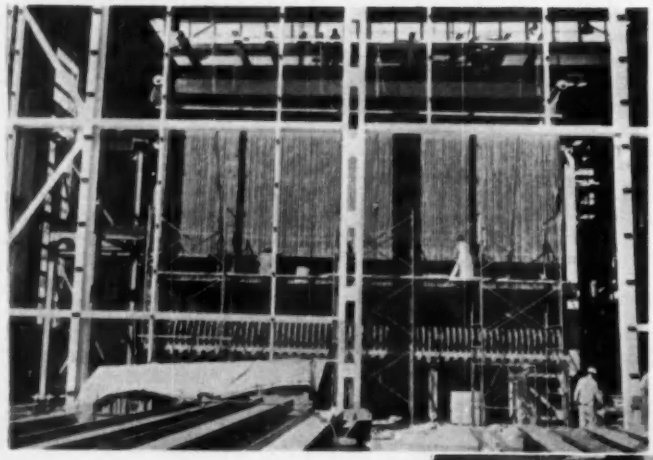
Boiler plant

The complete station will house six boilers, each of 315,000 lb./hr. capacity at a pressure of 625 lb./sq. in., and at a final steam temperature of 865 deg. F. All the boilers are being supplied by Babcock & Wilcox Ltd., and are of type F.H. integral furnace construction, arranged for oil-firing.

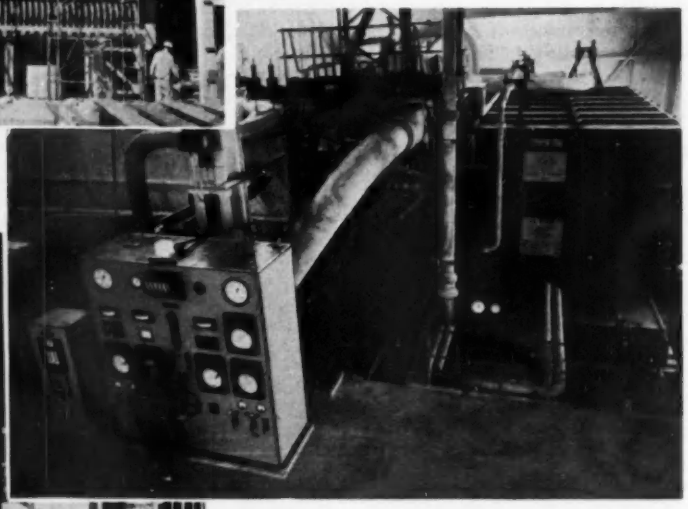
The earlier and adjacent North Point "A" station is equipped with 22 boilers which have been supplied by the Babcock organisation over a period of more than 40 years. The first boilers were all coal-fired units, but subsequently a change-over to oil-firing was adopted and the three most recent boilers in the "A" station are oil-fired type F.H. integral furnace units—two being rated at 150,000 lb./hr. and one at 200,000 lb./hr., with steam conditions of 425 lb./sq. in. and 775 deg. F. The selection of integral furnace boilers for the new "B" station, following experience with this type of unit in the old station, may be regarded as endorsement of the good performance of this type, the outstanding characteristics of which are its compactness, quick steaming, high efficiency, flexibility of operation and high availability. The Babcock & Wilcox plant comprises cross-flow tubular-type air-heaters, the oil-firing equipment with Y-jet wide-range steam atomisers, Babcock-Tate electrical sequence controlled sootblowers, steam and feed piping, and the 65-ton overhead travelling crane in the turbine house.

The boilers are the largest of the F.H. integral furnace type yet constructed by Babcock & Wilcox Ltd.—the heating surface of each unit being 23,236 sq. ft. The superheaters are of the Pendant multi-loop type having primary and secondary sections giving a total superheater heating surface of 7,970 sq. ft. per boiler. For each boiler there are two B. & W. inter-stage surface-type attemperators arranged in tandem; Bailey automatic temperature control is also provided.

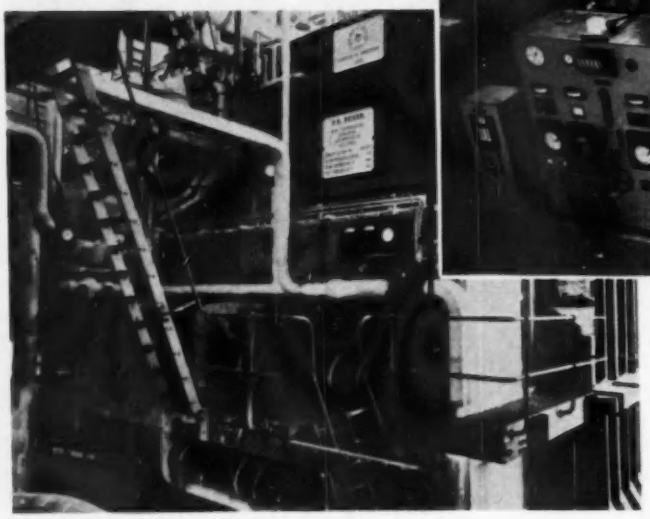
The horizontal-tube cross-flow air-heater on each boiler has a heating surface of 45,400 sq. ft., and is arranged in two banks with two air-passes.



(Above). Side view of No. 2 type F.H. integral furnace boiler during final stages of erection.



(Above). View at operating level of No. 1 boiler and airheater, also showing Bailey panel, and Babcock/Tate sootblower control panel.



(Left). Another view of No. 1 boiler unit showing the six B & W oil burners located in the side wall.

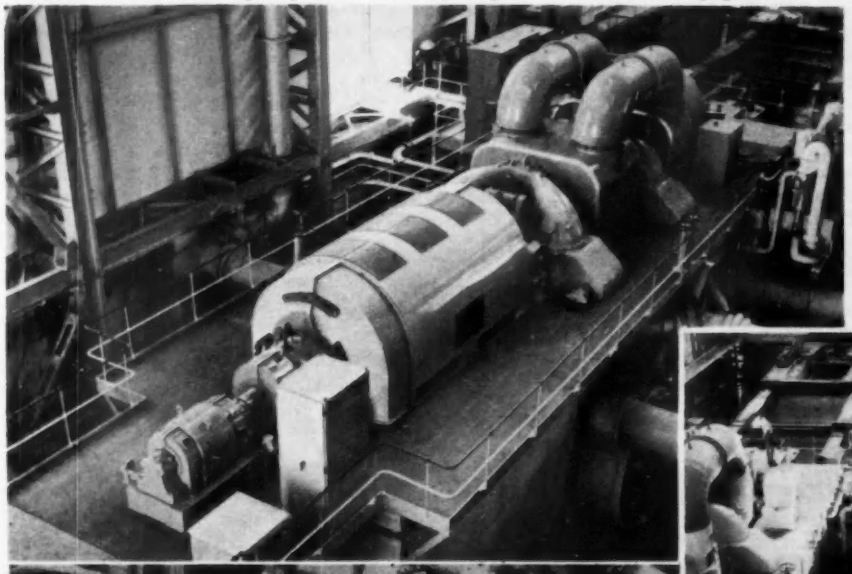
The furnaces are of tangent base water-tube construction, with burner walls of spaced bare water-tubes. The floor tubes are refractory covered. There are six Babcock 24½-in. Y-jet oil-burners in each side wall, as shown in the accompanying outline arrangement of the boilers.

The F.D. and I.D. fans are being supplied by James Howden & Co. Ltd.—all fans being of the double-inlet vane-control type. The F.D. units (one per boiler) are of 89,000 cu. ft./min. capacity and driven by English Electric two-speed motors of 263/115 b.h.p., and the i.d. units (also one per boiler), of 160,500 cu. ft./min. and driven by English Electric two-speed motors of 515/290 b.h.p.

Lockheed hydraulic control equipment, allowing for remote control from the boiler control panel, is provided for change speed operation of the F.D. and I.D. fans, and also for control of all the boiler dampers. The Babcock sootblowing equipment supplied for the boilers and the air-heaters includes rack-type long-traverse blowers, and "unidirectional"-drive non-retractable element multi-jet blowers. The complete sootblowing equipment is provided with Babcock/Tate electrical sequence control—the control cubicles being located alongside the boiler control panels.

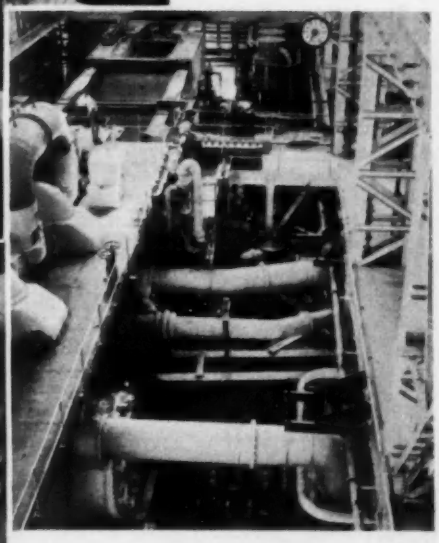
Automatic steam temperature control equipment of the compressed-air-operated type, and supplied by Bailey Meters & Controls Ltd., is provided. The boiler and turbine control panels, which are located on the turbine operating floor level, were also supplied by Bailey Meters & Controls Ltd., who in addition, were responsible for the instrument equipment, and the three-element automatic control equipment for boiler water-level. The boiler mountings, high-pressure valves and various pipe-line valves, were supplied by Dewrance & Co. Ltd.

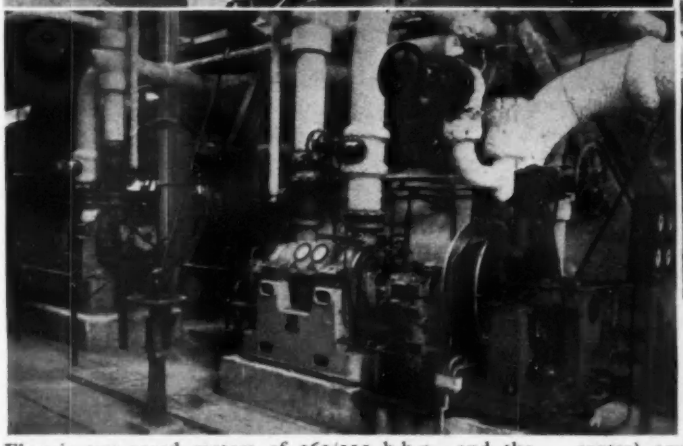
Insulation material for the boilers, ducting, steam piping, and for the turbines, was manufactured by The Chemical & Insulation Co., Darlington, and applied on site by the Darlington Insulation Co. Ltd. The insulation for the boiler walls and tops, comprises high-temperature and 85 per cent. magnesia slabs and 85 per cent. magnesia plastic—the whole being finished with armouring compound and emulsified bitumen. Meta-Dextramite insulation was used together with magnesia on the high-temperature steam piping.



(Left). One of the five English Electric 30-MW turbo-alternator sets.

(Below). View looking into turbine house basement showing circulating water supply pipes to condensers.





(Left). One Sulzer electrically-driven boiler feed pump is provided for each boiler together with one standby steam-driven pump for each pair of boilers.

The fuel oil is pumped from large storage tanks to boiler day tanks, each of 250-tons capacity (there being one tank per boiler), and then to the oil burners on the boilers, via a pumping and heating unit.

Boiler feed pumps

Feedwater is delivered to the boilers by feed pumps supplied by Sulzer Bros. (London) Ltd., and located in the turbine house, between the turbine and boiler units. One electrically-driven feed pump is being provided for each boiler, together with one standby steam-driven pump for each pair of boilers. All the pumps are of the same size, of barrel-casing design arranged for centre-line mounting and having seven stages. Each pump is designed for an output of 350,000 lb./hr. against a discharge pressure of 826 lb./sq. in., with feedwater having a temperature of 200 deg. F. The pump speed is 2,950 r.p.m., the driving motors, for the electrically-driven sets which are of English Electric Co.'s manufacture, and also the turbines for the steam-driven sets have a full-load rating of 490 b.h.p.

Turbo-alternators

The station will ultimately contain five 3,000 r.p.m., 30-MW turbo-alternators designed and supplied by the English Electric Co. Ltd. The steam from the six boilers is delivered to three inter-connected steam receivers which are made and supplied by Babcock & Wilcox Ltd. Thus, there is one steam receiver per pair of boilers, and they are located in the station basement. From the receivers the steam is passed from the valved points direct to the steam chests of the turbines, which are of the two-cylinder impulse reaction type with double-flow l.p. cylinders, designed for steam conditions of 600 lb./sq. in. and 850 deg. F., with 27.85 in. vacuum at m.c.r. There are four stages of bled-steam feed-heating giving a final feed temperature of 340 deg. F. under economic rating conditions. The h.p. section has 20 stages of impulse blading, and the l.p. section, reaction blading and double-flow with 10 stages on each flow. The exhaust steam from the turbine is condensed in twin-shell condensers located under each set. These condensers, each with a cooling surface of 32,300 sq. ft., are of the two-pass type, and they utilise 26,000 g.p.m. of sea water at 86 deg. F. for cooling purposes under m.c.r. conditions.

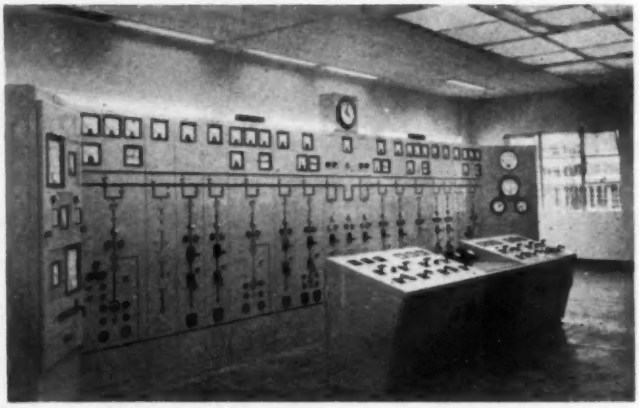
Each alternator, of the closed-cycle air-cooled type, generates electricity at 11,800 volts, three-phase, 50 c/s, and is solidly connected to an English Electric generator transformer which steps up the voltage to 22,000. Gilled-tube surface-type coolers are provided and ventilation is effected by fans supplied by James Howden & Co. Ltd.

The condensed steam from the condensers is fed back to the boilers, but to compensate for losses, make-up water is purified by means of triple-effect evaporators supplied by Aiton & Co. Ltd., Derby. Two central evaporating plants, each of 26,000 lb./hr. capacity, will be installed in the completed station, and they will be fed from the raw water mains.

Circulating-water system

The circulating-water required for the condensers, the air-coolers, generator transformer oil coolers and the oil coolers of the turbo-alternators is drawn from the sea by pumps supplied by Drysdale & Co. Ltd., Glasgow. There will be six of these pumps in the completed station, each pump being capable of delivering 27,500 g.p.m. Fixed screens are fitted at the intakes to the circulating-water pumphouse, and six central-flow-type band screens for the removal of debris will ultimately be installed between the fixed screens and the pumps, one on each pump intake. These screens are being supplied by F. W. Brackett & Co. Ltd., Colchester.

Chlorinating plant, supplied by Wallace & Tiernan Ltd., is provided for the injection of chlorine into the circulating-water to prevent growth of mussels and slime in the culverts and condenser tubes. This automatic intermittent chlorination of the cooling water, obviates the need for periodic manual cleaning of the condensers.



View in station main control room.

Electrical equipment

The turbo-alternators and outgoing feeders for both "B" station and Nos. 10 and 11 machines in the "A" station will all be controlled from the station control room located on the east side of the turbine room. The 22,000-volt cables from the main generator transformers are taken to the 22,000-volt switchgear, which is of the metal-clad oil break type, located in a separate building beside the station. The station auxiliaries are supplied from two sources namely, a station transformer connected back to the "A" station 6.6 kV switchboard and stepping down to 3.3 kV, and a unit transformer connected directly to the generator terminals and stepping down to 3.3 kV. Further step-down transformers reduce the voltage to 415 for the low-voltage auxiliary gear. The auxiliary switch-gear is mounted in the auxiliary bay between the turbine and boiler house, the 3.3 kV switchgear at turbine operating floor level and the 415 volt gear in the basement, both being of the air-break type.

In conclusion, we should record our acknowledgments to Mr. W. Stoker, general manager, Hong Kong Electric Co. Ltd., for granting us permission to publish this description, and also to the English Electric Company's general engineering projects department, London, for their assistance in the preparation of the description and for providing some of their photographic prints from which the illustrations were reproduced.

Uranium Fuel Element Production at Springfields

THE Springfields factory of the United Kingdom Atomic Energy Authority occupies a site of some 218 acres, between Preston and Blackpool, and it is here that the uranium, upon which, at the present time, Britain's atomic energy project depends, is processed. Source material, in the form of ore or concentrates, is treated to produce pure uranium metal for reactor fuel, or uranium hexafluoride for the Authority's gaseous diffusion plant at Capenhurst. It is here, also, that the uranium metal is formed into rods and assembled into fuel elements for the reactors at Calder Hall, Chapelcross, and the "Bepo" reactor at Harwell. This work will, of course, soon be extended to include the manufacture of fuel elements for the nuclear power stations now under construction for the Central Electricity Generating Board. Throughout, it has been the policy to keep the Springfield processes free from problems of criticality, and for this reason any uranium or compound in which the proportion of U^{235} is high enough to constitute a criticality risk is handled at other works of the Authority. It is for this reason that fuel elements for the fast reactor, and for the test reactors, Dido, Pluto, and D.M.T.R. are made at Dounreay.

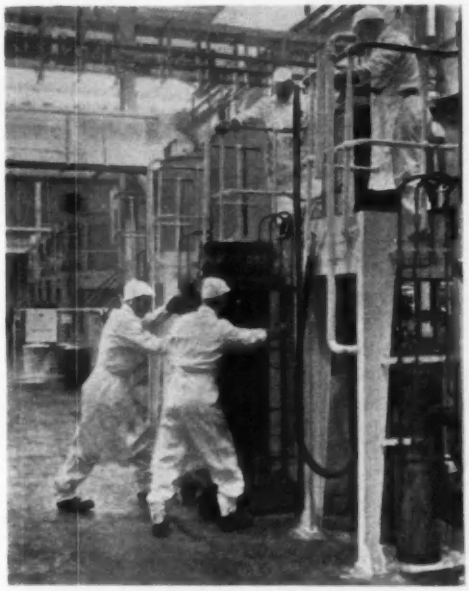


Fig. 1 (left). Moulds for uranium fuel rods being placed into the vacuum casting furnace. A bell (as seen in the illustration) is placed over the furnace before casting.

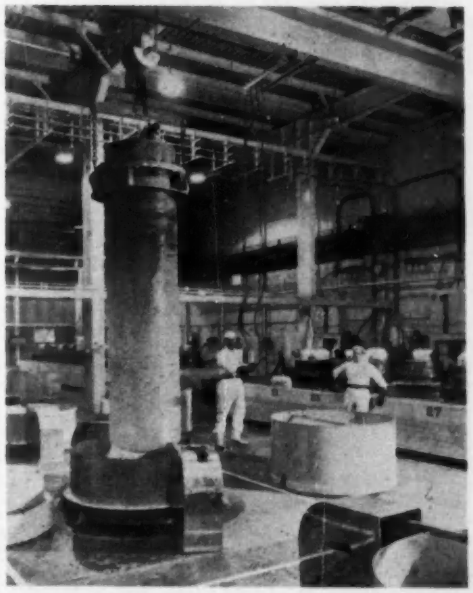
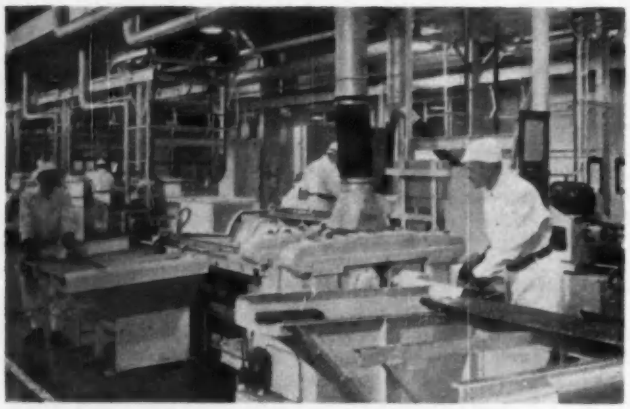


Fig. 2 (right). The magnesium reduction of uranium tetrafluoride to uranium metal takes place in a reactor heated in an electric furnace. A reactor is shown here being removed from the furnace, prior to being transferred to the cooling bay.

The organisation at Springfields was formed in 1946, and less than two years later—in January, 1948—the first consignment of uranium ore was received. In October of that year the first uranium rods were produced, and since then more than a million fuel elements of various kinds have been produced at the factory. Originally, pitchblende was used as the starting material for the process, but now, a new process is planned, using a concentrate (crude uranium oxide) as the starting material, which will eliminate a necessary stage—peroxide precipitation.

The concentrate is delivered in drums to the ore storage area, taken by lift to the tipping area as required, and the concentrate tipped into a hopper with a screw-feed to the dissolvers. In these large stainless-steel tanks, fitted with steam heating coils and stirrers, the concentrate is dissolved in nitric acid and the solution, after cooling, is fed to rotary filters. These consist of large rotating horizontal drums of fine mesh, with a vacuum applied to the inside. The lowest part of the drum dips into the slurry from the dissolver, the solution of uranyl nitrate is sucked through the mesh, while the solid impurities are collected on it and then continuously scraped off. These solid scrapings are re-slurried and passed to a second similar filter to ensure that all traces of uranium are removed. The uranium solution is then purified by solvent extraction with a solution of tributyl phosphate (T.B.P.) in odourless kerosene in mixer-settler units arranged in a cascade. Each unit consists of a mixing section in which the two liquids separate into layers owing to the difference in their densities. Because of its greater solubility in T.B.P., the uranyl nitrate collects in the solvent phase, leaving the impurities in the aqueous phase. From the settler section, the solvent phase flows "up" the plant to the next mixer section while the aqueous phase flows "down" to the next mixer section. In this way, the removal of uranyl nitrate from the aqueous phase can be made almost complete. At the top of the plant, the tributyl phosphate emerges containing the uranyl nitrate in solution, passes through a heating unit and the uranyl nitrate is then washed out of the solvent by a weak nitric acid solution. The uranyl nitrate solution is treated with ammonia to precipitate the uranium as ammonium diuranate. This compound



The fuel rod machining line. Here the rods are straightened, cut to slightly more than the required length, then grooved to facilitate later operations.

is then put through the "Dryway" plant to emerge as uranium tetrafluoride. Ultimately it is planned to carry out this part of the process by fluidised bed methods and development work is at an advanced stage. The section of the new plant in which this will be done is at present under construction.

The uranium tetrafluoride, and magnesium turnings, are then delivered to an automatic weighing and mixing machine which feeds the pelleting press. This also is automatic, and ejects the pellets to a conveyor which delivers them to the reactor breakdown and loading section. The reactor is, in effect, a crucible which consists of a long steel cylinder containing a sectionalised graphite lining. The pellets of UF_4-magnesium are built up inside the lining and the whole assembled into the reactor. The reactor is passed into the adjacent furnace bay where it is placed in an electric furnace in which the reduction reaction takes place. After cooling, the reactor is brought back, dismantled and the slag and uranium billet removed. The billet then goes to the cleaning section where it is cleaned, sampled and numbered, and sent to store.

Conversion of the uranium metal into a fuel element begins with the melting of the billet in a vacuum furnace heated by a high-frequency induction current and pouring the molten metal into cylindrical moulds. After cooling, the mould assembly is dismantled and the rods taken into the bond store, each cast being kept separate. The rods then undergo a succession of machining operations to bring them to the desired design, with heat treatments included to produce a satisfactory metallurgical condition to minimise distortion during irradiation. This is, in effect, a small, randomly oriented grain size. The machining operations are conventional, and are carried out on standard lathes or centreless turners, the only special precautions taken being the provision of an exhaust system away from the operator and a copious supply of coolant to prevent ignition of the swarf and minimise the risk of particles escaping into the atmosphere. The turnings are collected, cleaned and added to subsequent casting charges. Finally, the rods after being inspected, checked for dimensional accuracy and individually numbered, are sent for assembly into fuel elements.

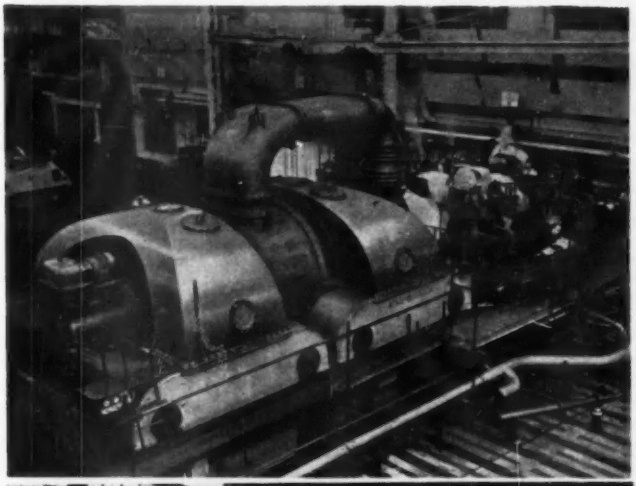
Early fuel elements, for Bepo and the Windscale reactors, used aluminium as the canning material, but the higher operating temperature in the Calder Hall reactors meant that aluminium would lose so much of its strength that it was no longer suitable. The change from air to relatively inert carbon dioxide as the cooling gas eliminated the fire risk associated with magnesium, and the cans for Calder Hall, Chapelcross and the reactors of the nuclear power stations now under construction are of a magnesium alloy known as "Magnox." The cans arrive at Springfields individually packed, and consist of open-ended finned tubes. After degreasing in trichlorethylene, they are examined and comprehensively

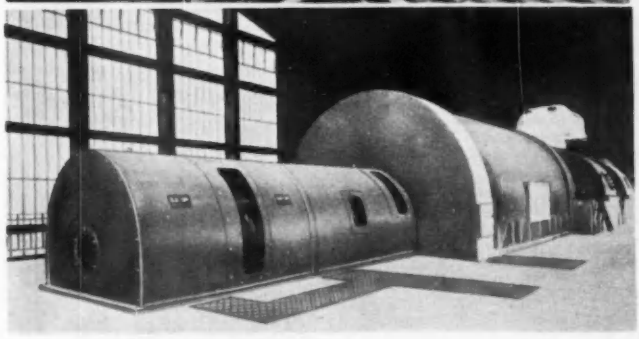
Two views of the fuel element fabrication line, showing (on left) the beta-quench apparatus. A uranium rod is seen being removed after treatment to reduce the grain size of the uranium metal. (Right). Alpha-annealing apparatus in which the rods also undergo heat-treatment to reduce grain size of uranium metal. An assembly of 30 rods is being lowered into a container for loading into the furnace.

gauged. A cup is inserted in one end and welded in position automatically in an inert atmosphere of argon. After the efficiency of the weld has been examined and tested, the uranium bar is loaded into the can. Because of the importance of avoiding any surface contamination of the can by particles of uranium, the bars are not allowed into the same shop as the cans, but are fed into them though a hole in the wall. The second end of the can is then sealed up by inserting a cup and welding in the same way as the first end, and the completed can is "pressurised" in an autoclave. The effect of this is to squeeze the can firmly on to the rod and ensure good transfer of heat from rod to can. Various tests follow, the can is cleaned again, end pieces and braces are attached and the fuel element, ready for use in a reactor, is packed for despatch.

First 120-MW Turbo-alternator Set Commissioned

The first of the four 120-MW 3,000 r.p.m. turbo-alternator sets being supplied by A.E.I. Turbine Generator Division, Trafford Park, Manchester, to Blyth "A" power station (Northumberland) of the C.E.G.B., was commissioned a few weeks ago. It is the first 120-MW set to be commissioned in Great Britain, and is the first of nine such sets being supplied, together with the associated condensing plant, feed heating plant, and deaerating equipment, to various C.E.G.B. stations, e.g., Agecroft "B" and Staythorpe "B." The stators of these generators weigh approximately 135 tons each, thus necessitating, of course, special transport arrangements. Because of bridge reconstruction work on the Great North Road, the stators for Blyth "A" are being transported by road to Birkenhead, then 700 miles by sea round the north of Scotland to Newcastle upon Tyne, and from there to Blyth by road. The stator for No. 2 has arrived at Blyth and is being erected. The turbines at Blyth are to be supplied with steam from unit boilers each of 860,000 lb./hr. capacity, and made and erected by Babcock & Wilcox Ltd. Steam conditions at the turbine inlet are 1,500 lb./sq. in. and 1,000 deg. F., with re-heat to the same temperature.





Various new features have been introduced in the design of these 120-MW reheat turbines. With the increase in output, solid instead of flexible couplings have been adopted, and the three rotors have been bolted together to form, in effect, a single four-bearing shaft with one thrust bearing; the mechanical losses are appreciably lower than in an arrangement with six journal bearings and three thrust bearings. The single-thrust bearing is housed in a centre pedestal between the inlet ends of the high-pressure and intermediate-pressure cylinders, an arrangement that maintains clearances between stationary and rotating elements despite any rapid changes in temperature, as may occur, for example, during starting. Another advantage of the arrangement is that steam-flows through the h.p. and i.p. cylinders are axially opposed, and the resultant load on the thrust element is consequently reduced. The steam conditions permit the use of single-shell casings in cast molybdenum-vanadium steel for both the h.p. and i.p. cylinders. H.p. and i.p. rotors are of molybdenum-vanadium steel, and the low-pressure rotor is of high chromium alloy steel; all three rotors are of integral disc construction. The exhaust blading of these 120-MW turbines is designed for vortex flow; the blades are of greater length and mean diameter than those of the earlier reheat units, the effective leaving area having been increased by over 40 per cent.

(Upper). The first 120-MW set undergoing tests at the A.E.I. works at Trafford Park.
(Lower). The same set installed at the Blyth "A" power station.

C.E.G.B. APPOINTMENTS

Mr. A. R. Cooper, M.Eng., M.I.E.E., M.Inst.F., a full-time member of the Central Electricity Generating Board, and director of the Board's Eastern, London and South Eastern Region, is to take up special responsibilities for the operations (including nuclear) and personnel work of the Board. Upon taking up these duties, Mr. Cooper is relinquishing his position as regional director. **Mr. A. E. Hawkins,** B.Sc. (Eng.), A.M.I.E.E., at present system planning engineer of the Board, will take up the appointment of chief operations engineer and will be responsible direct to Mr. Cooper for operations, including national control. **Mr. S. S. Scott,** M.A. (Oxon), chief personnel officer, will also be responsible direct to Mr. Cooper. As a consequence of Mr. Cooper's appointment, the following reorganisation takes place on March 1st. The position of regional director of the Eastern, London and South Eastern Region will be filled by **Mr. H. J. Bennett,** A.M.I.E.E., F.B.I.M., at present deputy-director of the region and controller of the London Division. **Mr. L. W. Stretton,** M.I.E.E., chief generation engineer of the Eastern Division, will become controller of the London Division. **Mr. P. W. Cash,** B.Sc. (Eng.), A.C.G.I., M.I.E.E., who is at present system operation engineer at headquarters, will become system planning engineer. **Mr. D. P. Sayers,** B.Sc., M.I.Mech.E., M.I.E.E., M.Amer.I.E.E., will remain responsible to the deputy chairman for all commercial matters and will hold the position of chief commercial officer.

A Self-regulating Alternator

A SELF-REGULATING alternator has been developed by W. H. Allen Sons & Co. Ltd., primarily for marine applications, where there is a need to accept the transient loads represented by the direct-on-line starting of relatively large squirrel-cage induction motors. Such units will, of course, also be suitable for general use, as for example, in the case of stand-by sets for pumping stations, and other industrial installations. Two ranges are to be manufactured, the first from approximately 200-1,500-kW, for turbo-alternator sets running at 1,500 to 1,800 r.p.m. (or above if required), and the second from 100 to 1,000-kW, for diesel-driven alternators running at 250 to 1,200 r.p.m.

The new unit represents the result of the application of a completely static excitation and regulating system to the well-known "Allen" marine-type alternator. The alternator itself is of normal construction, but the conventional shunt-wound d.c. exciter is replaced by a completely static excitation system of transformers and rectifiers in which shunt and series elements are so combined as to produce inherently an alternator field current closely approximating to that required for the maintenance of normal voltage. Precise steady-state control to fine limits is maintained by means of a static automatic trimming regulator. The patented excitation system employed has been used extensively for relatively small machines since its development in this country some years ago, and its originators, Arthur Lyon & Co. (Engineers) Ltd., have collaborated with W. H. Allen Sons & Co. Ltd. in its application to the new alternator. A schematic diagram of the complete excitation and control system, including alternative hand control, parallel running compensation, and the initiative pilot exciter connections, is shown in Fig. 1.

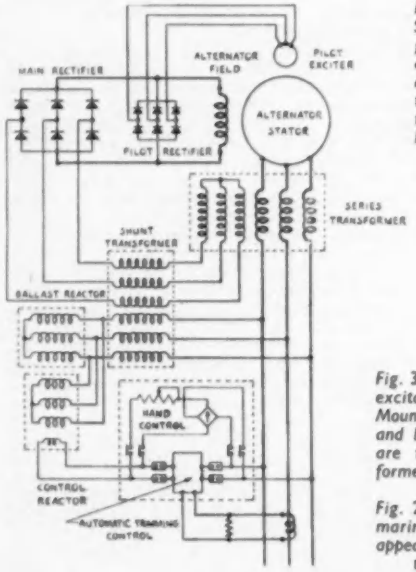


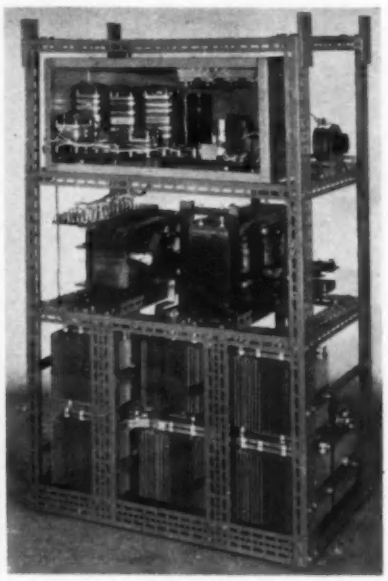
Fig. 1 (left). Schematic diagram showing complete excitation and control system for the self-regulating alternator.

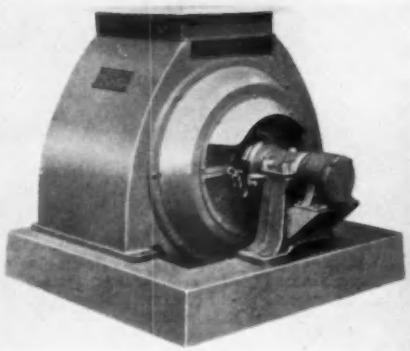
The principle of operation is that of phase-compensated line-current-compounding, a shunt transformer providing a "no-load" excitation component, and a series transformer an additional "on-load" component. The rectified output from the series-connected transformer secondaries is fed to the alternator field winding. A ballast reactor in the shunt circuit provides some measure of compensation for the resistance/temperature variations of the alternator field, and it also assists the transient voltage response. Fine control is obtainable in both circuits by means of adjustable air-gaps on both the ballast reactor and the series transformer.

A static automatic trimming control has been introduced to provide extremely accurate voltage-level control. This comprises a simple automatic regulator of the static magnetic amplifier type, the output current of which controls the impedance of a saturable control reactor connected in parallel with the ballast reactor. The total impedance of the shunt transformer circuit is therefore varied slightly in response to any small voltage changes detected by the regulator, and the steady-state alternator voltage is maintained automatically within the usual $\pm 1\frac{1}{2}$ or 2 per cent. of normal. If parallel running compensation is required, a conventional "quadrature droop" compensation signal (obtained from a current-transformer-fed resistor) is introduced

Fig. 3 (right). The prototype of the excitation and control equipment. Mounted at the top are the control and ballast reactors. Below these are the shunt and series transformers, and in the base, the rectifiers.

Fig. 2 (below). An Allen standard marine-type alternator, as it will appear when adapted for use with the new excitation system.





into the voltage detector circuit of the automatic trimming control. As a precaution, against a possible failure of the automatic trimming control, a manual control unit, comprising a small auxiliary rectifier and regulator, has been provided, together with an " auto/manual " change-over switch.

With the self-regulating alternator, upon application of load, the initial voltage dip is considerably reduced by

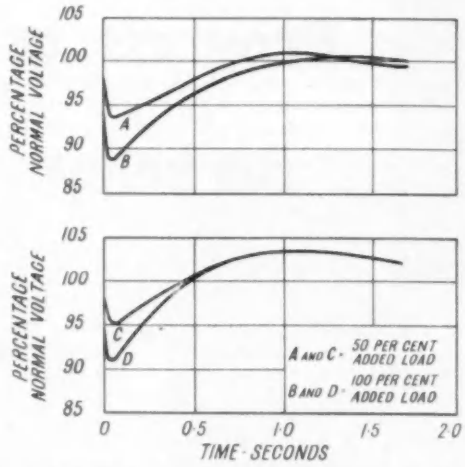


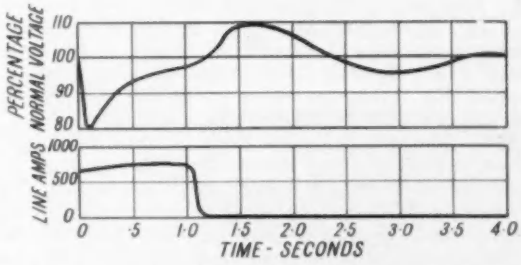
Fig. 4 (above). Voltage response oscillograms from no-load (top), and with alternator preloaded at normal full-load excitation (bottom). All loads are at zero power factor.

Fig. 5 (right). Oscillogram for direct-on switching of squirrel-cage induction motor with standstill short-circuit current of 850-A at 450-V.

the almost instantaneous effect of the series element in the total excitation, and by the further elimination of the delay associated with a rotating exciter an extremely rapid voltage recovery is obtained. The results obtained on a 350-kW turbo-alternator running at 1,800 r.p.m. are shown in Figs. 4 and 5, from which it may be seen that while the initial voltage dip is extremely low, the recovery to normal voltage is, in fact, faster than is possible with a conventional alternator with a normal exciter and a.v.r. In general, an initial voltage dip of only about one-half of that of a conventional alternator has been achieved, the voltage recovery being about twice as fast.

On the occurrence of a short-circuit, the rapid response of the system has the disadvantage of producing increases of field current corresponding, partially, to the heavy increases in stator current. The resultant effect is that the transient short-circuit currents are rather higher than would be the case with a conventional alternator and a.v.r. The extent of the increase, with a typical turbo-alternator, may be expected to be of the order of 50 per cent., and due account of this must be taken when consideration is being given to the capacity of the main circuit-breakers and to the design of the protective system.

The extremely low residual voltage obtainable from many normal alternators is too small to initiate true self-excitation through the main excitation system, and the Allen system incorporates a small permanent magnet pilot exciter with an output not exceeding 200-W, to establish sufficient alternator terminal voltage to enable



the main excitation circuit to become self-sustaining.

A further advantage offered by the self-regulating alternator is increased flexibility of engine-room layout due to the reduction in overall length, and the ability to site the excitation cubicle in any convenient position reasonably close to the alternator.

INSTRUMENT MANUFACTURERS' LUNCHEON

Speakers at the annual luncheon of the British Industrial Measuring and Control Apparatus Manufacturers' Association (BIMCAM) in London a few weeks ago were unanimous in emphasising the importance of the British instrument industry to the future well-being of Great Britain and of every country throughout the world. Sir Ewart Smith, M.A., F.R.S., a deputy-chairman of Imperial Chemical Industries Ltd., proposing the ' success ' of the Association, spoke of the growing importance of instrumentation in the process industries. He pointed out how, in the old days, industrial plants were designed first, and instrumentation was added as something of an afterthought. Today, he said, instrumentation is an integral part of the initial design. He went on to recommend an ever closer association between the instrument manufacturer and the instrument user, so that an even greater understanding of each other's problems might be achieved. Sir Ewart Smith and the other speakers were introduced by Mr. L. S. Yoxall, president of BIMCAM, who also proposed the toast to the guests. Mr. D. B. Pinkney, chairman of the Association, replied to Sir Ewart Smith, and in acknowledging the thanks of the instrument manufacturers to the plant engineers, he pointed out that what instrument manufacturers were really selling was an engineering service. He outlined the aims of BIMCAM and mentioned that the Association now represents some 42 companies with a combined annual turnover of more than £25 million. Responding for the guests, Mr. H. Landeweer, head of the Instrumentation Department, Royal Dutch/Shell Group, The Hague, called for a greater degree of free competition, unhampered by national frontiers. Mr. Landeweer referred to the great advances now being made in instrumentation design and manufacture in such countries as Germany and Japan, and emphasised that, in his opinion, the foremost requirement in instrumentation is quality. He concluded by reminding the members of BIMCAM that industrial instrumentation not only increases the efficiency and prosperity of the process industries, but, in addition, basically assists in raising the standards of living on a national and world-wide scale. The British Industrial Measuring and Control Apparatus Manufacturers' Association, which was inaugurated in January, 1944, is an association of British manufacturers of industrial instruments for measurement and automatic control, freely uniting in their common interest to further the development and efficiency of their industry. The Association is the recognised point of contact with the manufacturing industries and public authorities using its members' products, and contains within its membership the most important firms in the United Kingdom engaged in industrial instrumentation. BIMCAM organises, with related associations, the International Instruments, Electronics & Automation Exhibition which takes place in London every two years.

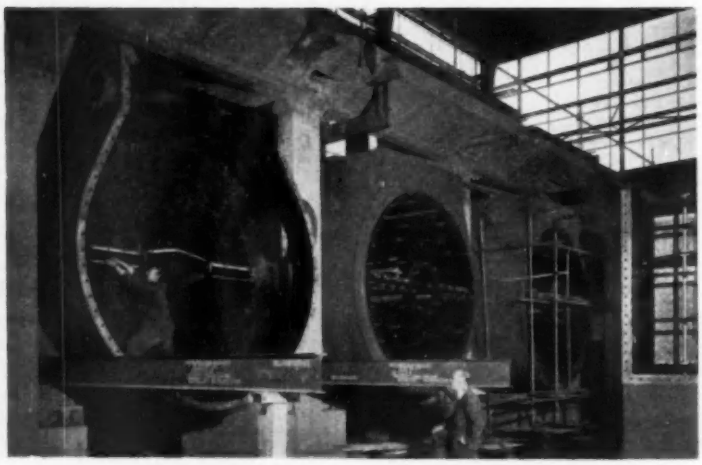
Two Years' Progress at Berkeley

IN the last issue of this journal, we included brief references to constructional progress made at the sites of the three nuclear power stations now being constructed for the Central Electricity Generating Board. Since these references were published, we have had the opportunity of paying a visit to one of the stations—viz., Berkeley, on the banks of the River Severn in Gloucestershire. We thus include in this issue some more comprehensive notes on the constructional progress made to date, and which brings the project about half-way towards completion. This station is being constructed by the A.E.I.-John Thompson Nuclear Energy Co. Ltd., with John Laing & Son Limited responsible for the civil engineering work for the two reactors and cooling ponds, and Balfour Beatty & Co., for the construction of the turbine houses, workshops, administration buildings, and the cooling-water supply system.

The present state of construction may be gathered from the accompanying aerial view. Virtually complete are the cooling-water intake works and tunnel. Some 100,000 cu. yd. of concrete, 5,500 tons of reinforcement steel and 1,600 tons of structural steelwork have already been placed in connection with the civil engineering work on the two reactors and the cooling ponds. Balfour Beatty & Co. have completed much of the more difficult part of their contract, and their section of the power station will, it is stated, be finished ahead of schedule.

John Thompson Limited, Wolverhampton, who are responsible for the construction of the reactor vessels and the thermal shielding surrounding them, the 16 boilers or heat-exchangers, the diagrids, the fuel-charging and fuel discharging machines, and (to the design of the British Thomson-Houston Co. Ltd.) the 72 bellows units which are employed to control the deflections caused by expansion of the ducting which carries the CO_2 from the reactors to the heat-exchangers, report that No. 1 vessel has been welded, and the control rod and charge tube bosses are being inserted into the top dome of the vessel. After stress-relieving and pressure-testing, the annular cooling shell will be welded inside the vessel.

The Berkeley reactors are designed to operate continuously, so that fuel elements can be both loaded and unloaded while the reactors are in operation. It is estimated that the "life" of the fuel will be considerably lengthened in view of the fact that the elements will be individually supported within the reactors, and also in view of the fact that the working temperatures have been conservatively chosen. Each of the two reactor pressure-vessels are 80-ft. high, and about 50-ft. in diameter. Each vessel comprises top and bottom bowls, with a central cylindrical body section—all made from 3-in.



The aerial view at the top of this page shows the extent of the site at Berkeley. To the left of the centre is No. 1 reactor which is well advanced. No. 2 reactor can be seen a little to the right, and the turbine house behind them.

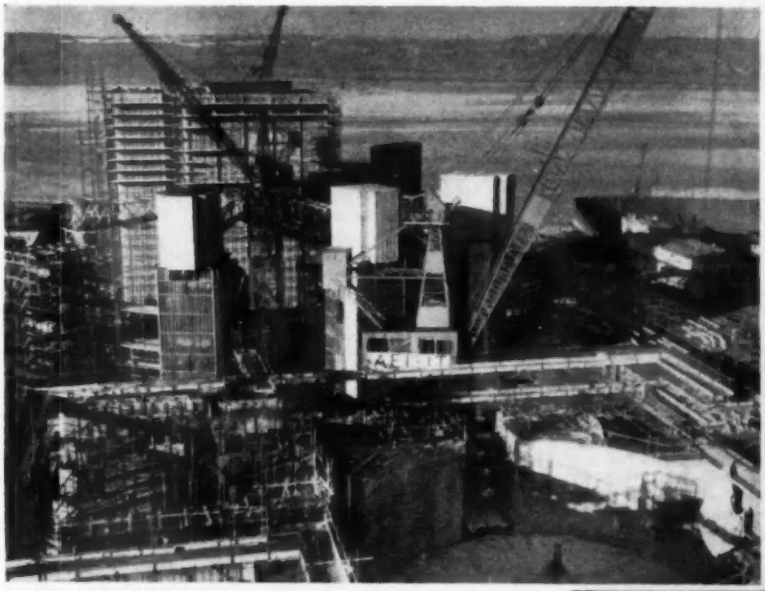
(Right). One of the three-shelled condensers, which, with the associated turbo-alternators are being supplied by the A.E.I. Turbine-Generator Division, being installed at Berkeley.

thick steel plates hot-pressed to shape, and having all edges prepared for welding by a special flame-planing technique developed for the purpose by John Thompson Ltd. All parts have been fabricated at the Thompson Works at Wolverhampton and transported for assembly and welding together on site.

The centre cylindrical section which forms 45-ft. of each vessel's 80-ft. total height is made up of five bands of steel plates, built up plate by plate above the lower bowl. The first four bands comprise eight plates, each 8-ft. 7½-in. deep and 3-in. thick. The fifth band, however, is of 10-plate construction, eight plates being of 4-in. thickness and the other two having a thickness of 3-in. Into the 4-in. plates forged sleeves are welded for the reception of outflow gas-ducts connecting to the eight heat-exchangers. On specially-prepared jigs, the cutting of holes and welding-in of the sleeves was carried out at the Glasgow works of John Thompson, Wilson Boilers Limited. All plates are lifted singly into position for welding so as to avoid heavy crane lifts—the heaviest single lift is no more than 13 tons. Throughout, the vessels are manufactured from controlled-carbon, silicon-killed mild steel, to John Thompson's specification. Erection of the vessels is arranged to keep pace with the construction of the 9-ft. thick concrete biological shielding encircling the steel thermal shielding in which the vessels are positioned. The completed vessel weighs approximately 1,000 tons, and the diagrid at the base, which will carry the graphite blocks (about 2,000 tons) within the vessel, weighs 160 tons.

Fabricated in sections at the John Thompson Dudley works, the diagrids are made from girder-section steel. Forming the outer ring of each diagrid is girder section of 4-ft. 7-in. depth, and the grid making up the centre of the assembly is manufactured from 4-ft. 4-in. deep section. As mentioned above, the No. 1 reactor vessel has been welded, and work is proceeding on the control rod and charge tube bosses in the top dome. All the eight heat-exchangers (or boilers) for this reactor have been erected, and one of them has been completely cleaned and tubed out. During this process absolute cleanliness and humidity control is essential, and the staff have received special training for working in the air-conditioned assembly enclosure some 70-ft. above ground-level. The checking and cleaning of the heat-exchanger tubes continues by day and night.

On No. 2 reactor, the final set of body plates are about to be sealed in, and the plates for the top bowl are being fabricated. The completed diagrid has been lifted and placed in the vessel; heat-exchanger parts have been delivered and are being welded on site in the boiler assembly shop. We understand that the first of these heat-exchangers will be erected within the next three weeks.



(Left). No. 1 reactor structure nearing completion and, in the foreground, No. 2 reactor with its 8-ft. thick concrete biological shield and steel thermal shield being built below its sheltering lid.

(Below). Preparation for welding a tube header to a low-pressure steam evaporator on one of the eight heat-exchangers associated with No. 1 reactor vessel.

The heat-exchanger vessels or boilers are, like the pressure vessels, made up of top and bottom domes and a body built up from five sections of cylindrical shells. All these units, however, are fabricated completely from 1⅛-in.-thick steel at the John Thompson Wolverhampton works. The domed sections, after fabrication, are welded together at Wolverhampton, and sent to Berkeley as finished units. Before despatch, they are fitted with compensator rings to maintain the material's strength at the connections which are prepared for the gas-ducting

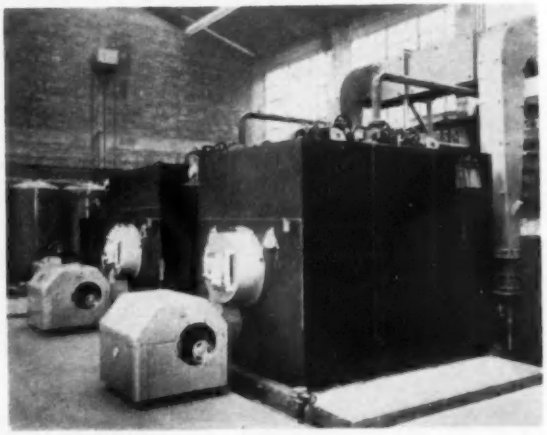
running to, and from, the pressure vessels. Each of the five body sections, which when welded together form the parallel section of a complete heat-exchanger, are fabricated from two steel plates by roll-forming cold, and afterwards longitudinally welding one-half to the other. These sections are fitted at Wolverhampton with their inlet sleeves for the connection of tubes to headers, on site. After welding, a heat-exchanger is stress-relieved and this is followed by the sealing of all apertures for the hydraulic testing (to 240 lb./sq. in.) of the vessel. With constructional work thus finished, the vessel, still on its rollers, is taken to the external loading bay where it is manoeuvred on to road bogies ready for moving to its foundations adjacent to the pressure vessel.

In the turbine house, the structure of which is practically complete, the condenser shells have been installed, and tubing is proceeding. Through its Turbine Generator and Heavy Plant Division, Associated Electrical Industries Ltd. is supplying the complete turbine house equipment, including (a) four 83-MW turbo-generator sets, (the 3,000 r.p.m. mixed-pressure turbines, will take steam at 310 lb./sq. in., and 604 deg. F., and at 64 lb./sq. in., and 596 deg. F.); (b) two "dump" condensers (for the reception of steam in the event of "shut-down" of the generating plant, steam-jet air-ejectors, water/water heat-eachangers, oil-coolers, and alternator hydrogen-cooler units. Other A.E.I. equipment includes 16 gas-circulators and gas-duct bellows units. The British Thomson-Houston Co. Ltd. is supplying the control-rod actuators and nearly 1,000 auxiliary motors of a total of about 22,000 h.p.

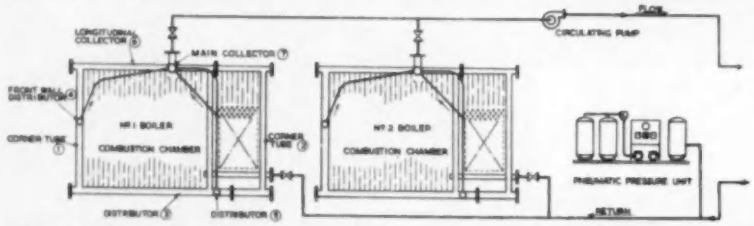
This 275-MW station—the construction of which was commenced in January, 1957, is expected to go on full commercial load during the winter of 1960/61.

CORNER-TUBE BOILER PLANT

Space-heating and process services in the new Sheffield factory of Metropolitan-Vickers Electrical Co. Ltd. are provided by two 5-million B.Th.U./hr. boilers, and two 10-million B.Th.U./hr. boilers, all of the corner-tube type, designed and supplied by Edwin Danks & Co. (Oldbury) Ltd. The boilers, which are claimed to be the first of this type to be installed in the United Kingdom, operate in conjunction with a high-pressure (120 lb./sq. in.) hot-water heating system. A Warmac pressurisation unit of the high-pressure type, and designed to accommodate the boiler flow temperature of 320 deg. F., and to work with a very close operating differential, is also incorporated. The engineering contractors for this installation were Saunders & Taylor Ltd., of Manchester. Features of the corner-tube type boiler include the fact that large down-comers, or corner tubes, permit a thermo-syphon circulation within the boiler itself which automatically provides self-balance for the water-tubes subject to the highest temperatures. There is no need for balancing orifices which may become blocked and cause the tubes to burn-out. Space saving is also achieved, as the combustion chamber associated with a corner-tube boiler is water-cooled and, therefore, requires less headroom than air-cooled units of a similar capacity.



(Above). Two corner-tube boilers, each of 5-million B.Th.U./hr. capacity, installed at the new Sheffield factory of Metropolitan-Vickers Electrical Co. Ltd.



(Left). Diagrammatic layout arrangement for two low headroom type corner-tube boilers, with pneumatic pressure unit.

After leaving the combustion-chamber the hot gases pass through a conventional bank at the rear of the boiler. This section contains a nest of small-bore tubes through which the return water passes before entering the radiant heating surface. Compared with the conventional forced-circulation water-tube boiler, the corner-tube type offers a very low resistance to the flow of water. In this particular plant the resistance is approximately two-thirds less, and represents a considerable saving in circulating pump horse power. The boilers are fired with 3,500 sec. Redwood No. 1 fuel-oil, through a new type of rotating cup oil burner—the 'Airspin'—also manufactured by Edwin Danks & Co. (Oldbury) Ltd. The atomising cup incorporated in the new burner rotates at high speed, thus obtaining optimum atomisation of the oil. High speeds result from the cup being driven through a turbine. Air is obtained from a secondary runner on the main forced-draught fan, and after driving the turbine, it is exhausted around the cup thus contributing further to the atomisation of the heavy oil. The burners are fully-modulating. The oil supply is linked with the forced- and induced-draught air supply to maintain the correct oil/air relationship throughout the extent of the burner turn-down ratio of four-to-one.

FURTHER £1 MILLION CONTRACT FROM RUSSIA

Rustyfa Limited, the British consortium company founded in 1957 for the purpose of supplying plant and equipment for an immense tyre factory now being built in the Ukraine, announce that, following negotiations in London, they have received a further order valued at over £1 million. This latest order, together with those announced in 1957 and 1958, brings the total of Rustyfa's contribution to Britain's export drive up to £14 million. David Bridge & Co. Ltd., Rochdale, and Francis Shaw & Co. Ltd., Manchester—are supplying most of the rubber processing plant, Crompton Parkinson Ltd., the electrical distribution equipment for all the sub-stations planned to date, and a large number of electric motors for auxiliary equipment. Lancashire Dynamo Holdings Ltd. are supplying all the large motors for plant drives (to be manufactured at Manchester), and associated control equipment through their subsidiary company, Lancashire Dynamo Electronic Ltd., Rugeley. Mather & Platt Ltd., impregnation and dipping processing lines, pumps and auxiliary services, including fire protection equipment at Manchester. Simon Handling Engineers Ltd., pneumatic weighing and handling equipment at Stockport.

Two Sets of General Purpose Diesel Engines

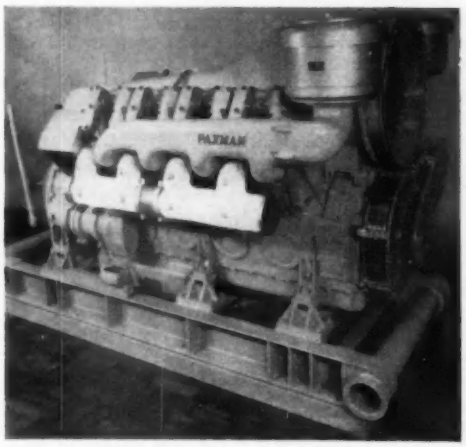
TWO ranges of diesel engines of new design have been developed by Davey, Paxman & Co. Ltd., to produce higher power output, within overall dimensions similar to those of existing Paxman units. One reason for the development of these new engines is to meet the present strong competition of manufacturers abroad. One set comprises Mark Y.G.A., air-cooled units having a horsepower range of from 160 to 466 b.h.p., while the second set comprises Mark Y.J.X. pressure-charged, and Mark Y.J.C. pressure-charged and intercooled, water-cooled engines with power outputs ranging from 1,100 to 1,870 b.h.p. Both sets of engines are additional to the existing marks of engine currently built by the company and have been designed and developed to achieve the same degree of reliability already attained by existing designs. During a recent visit to the Paxman works, at Colchester, we had the opportunity of inspecting representative examples of these new engines, two of which were undergoing exhaustive tests. Although completely new in concept, the design of many of the components is based on well-proven practice, while new items introduced as the result of a careful study of techniques in several spheres of engineering fields have been proved by intensive component rig tests. Tests of this character have paved the way of overcoming the teething troubles usually encountered at the prototype stage and, to establish service reliability, it is planned to test the engines under the wide range of operational conditions likely to be encountered at home and abroad.

" Vega " air-cooled engines

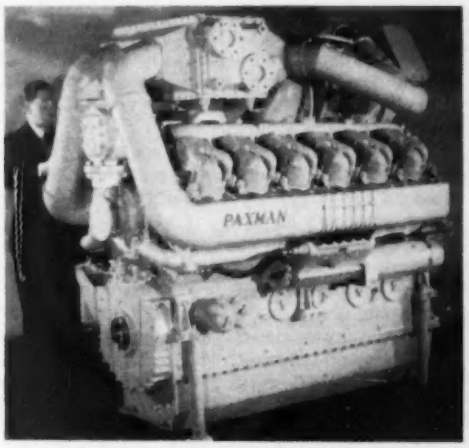
The increasing use of air cooling induced the company to investigate its application to higher powered units, and this has led to the introduction of the Mark Y.G.A. engine range which comprises a six-cylinder in-line engine, and eight- and 12-cylinder 90 deg. Vee-form engines. These engines are designed to be suitable for service as power units for various oil-well and oil-field applications, and also for traction purposes as well as for marine auxiliaries. With the " Vega," which is believed to be the largest air-cooled diesel engine available, for industrial purposes, the cylinders are all of 6-in. bore by 6.6-in. stroke, with a compression ratio of 15 to 1. Maximum torque occurs at about 1,350 r.p.m. and is:— 1,350 lb./ft. for the 12 Y.G.A.; 900 lb./ft. for the 8 Y.G.A.; and 675 lb./ft. for the 6 Y.G.A. The specific weight of the engines is approximately 10 lb. per b.h.p.

The general design specification of all engines is similar. The crankcase is a high-strength, spheroidal graphite-iron casting, carrying a nickel-chrome alloy steel crankshaft with hardened pins and journals. Thin wall copper-lead bearings are used for mains and big-ends. The individual cylinder heads and barrels are in one-piece aluminium castings with hardened and tempered cast-iron cylinder liners shrunk in. Single inlet and exhaust valves are mounted at a small inclination to each other, allowing the injector to be fitted in a nearly central position, and at the same time permitting adequate area for cooling air between the ports and the injector. The valves are operated by push rods from a camshaft mounted between the cylinder banks and driven by gearing from the drive-end of the crankshaft. Side-by-side connecting rods are used and cylinder barrels on each bank are staggered accordingly. An axial-flow cooling fan is driven from the free-end of the crankshaft by a Triplex chain, and the cooling-air is ducted to each cylinder bank. The combustion chamber is of the open type with a near central injector. C.A.V. type " NN " fuel-injection pumps are used with mechanical or hydraulic governors produced by Ardleigh Engineering Co. Ltd., where special governing is required. There are two lubricating-oil pumps situated in the sump, one supplies oil at high-pressure to the bearings and the other at low-pressure for circulation through the oil cooler, which is situated in the air stream at the end of one cylinder bank.

In the development of this engine, one of the first questions to settle was how best to achieve satisfactory cooling for a cylinder of the required power output. A careful study led to a programme of single-cylinder tests with different designs of cylinder heads and barrels.

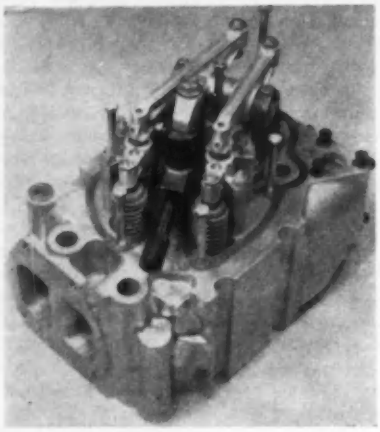


(Left). The Paxman 8 Y.G.A. " Vega " air-cooled Vee-form engine.



(Right). The Paxman 12 Y.J.C. " Ventura " pressure-charged and intercooled Vee form engine.

Three basically different designs of head and barrels were tested before the present design was evolved. This development of a cylinder head and barrel, capable of being cooled with reasonable economy in air-flow, has possibly been the most important aspect of the development of the engine as a whole. Parallel with this air-cooling development, combustion development was



An aluminium cylinder head for a Paxman "Ventura" engine.

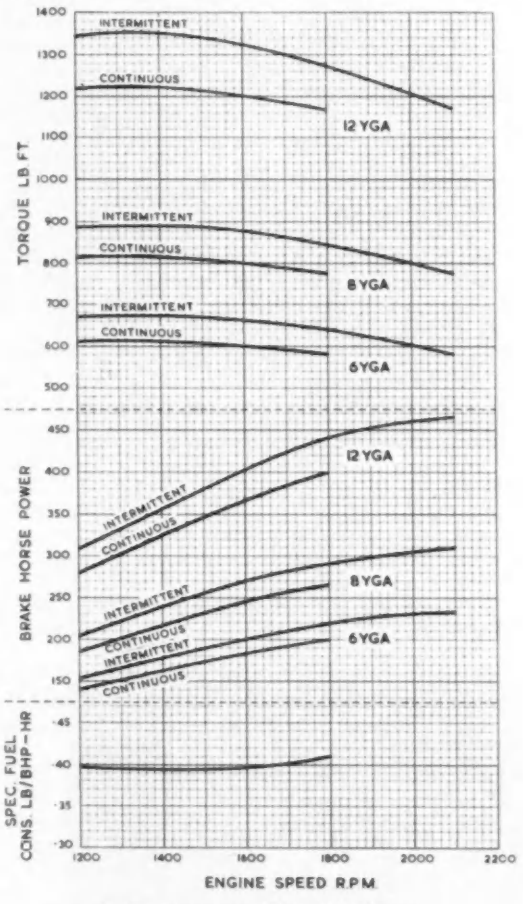
initially carried out on a water-cooled test unit, and considerable time was saved by being able to deal with these two lines of development concurrently and independently. In developing the "Vega," novel features of design were, as far as possible, subjected to intensive component rig tests. The value of these tests has been amply demonstrated by the fact that the first prototype achieved more than the designed power with only minor adjustment after initial running-in. The standard method of starting is by a 24-volt, 6-in. electric starter motor, and there is a 5½-in. dynamo for battery charging.

"Ventura" engines

The increasing demand throughout the world today for power units in the 1,000-2,000 h.p. range, having particularly small dimensions and high power to weight ratio, has led to the development of the "Ventura" range of lightweight high-performance units as an addition to the Paxman RPH/YHX range. The new engine naturally bears a strong family resemblance to existing Paxman engines, and the design has been based upon the very broad experience already gained in the operation of some thousands of high speed Vee-type engines; but the "Ventura" is fundamentally new having power, weight, and space characteristics claimed to be well in advance of anything which has previously been available from Paxmans. Besides having a large number of applications for the various power requirements in the oil fields, the engines are suitable for various forms of traction duty. By scientific design and careful disposition of material, specific weight has been reduced very considerably as compared with the Paxman 7-in. bore × 7¾-in. stroke engines. In fact, the "Ventura" 12-cylinder engine occupies no more space than the renowned 12 RPH engine although it is of twice the rated power. The "Ventura" range consists of the 12-cylinder pressure-charged (12YJX) and intercooled (12YJC) engines, and the 16-cylinder pressure-charged (16YJX) and intercooled (16YJC) engines. The new units are of open combustion chamber, direct injection design having a bore of 7¾-in., and stroke of 8½-in. The firing pressure is 1,250 lb./sq. in., and the operating speed 1,500 r.p.m. The horsepower ratings are given in the following table.

Engine mark	Industrial ratings at 1,500 r.p.m.	Traction ratings at 1,500 r.p.m.	Brake mean effective pressure (traction) lb./sq. in.
12 Y.J.X.	1,100 b.h.p.	1,200 b.h.p.	132
12 Y.J.C.	1,300 b.h.p.	1,400 b.h.p.	154
16 Y.J.X.	1,470 b.h.p.	1,600 b.h.p.	132
16 Y.J.C.	1,735 b.h.p.	1,870 b.h.p.	154

The specific weight for the four "Ventura" types varies between 6 lb. and 7.15 lb./b.h.p. The "Ventura" is a 60° Vee-type engine and as previously mentioned, follows in many respects traditional Paxman lines.



Performance curves of the "Vega" range

General departures in layout are, the mounting of the fuel pumps on the outside of each cylinder bank, and the use of a single turbocharger mounted above the engine. The crankcase and cylinder blocks are of monobloc construction, fabricated from machined steel plate and precision steel castings; and the forged-steel cylinder liners are chromium-plated internally and externally

and the bore treated for oil retention. The pistons are in light-alloy with hardened cast-iron ring inserts and are oil-cooled by a spray from the top of the connecting rod. Cylinder heads are high-strength aluminium alloy, carrying four valves with aluminium-bronze screwed-in valve seat inserts. The injector is centrally disposed, and each pair of valves is operated by a push rod by means of a single rocker and aluminium bridge-piece from a centrally mounted camshaft. Roller tappets are carried in separate castings. All connections to the injectors are outside the valve gear cover to eliminate all possibility of fuel-oil dilution. The drive to the camshaft, fuel pump, governor, oil and water pumps is by gear train from the drive-end of the crankshaft. Two lubricating-oil pumps are fitted, one for the pressure system to the bearings and the other for circulating oil from the sump through the external cooler. A single water pump is used, and a thermostatic by-pass valve is fitted as an integral part of the water system. The arrangement of the cylinder head is shown in one of the accompanying illustrations. Monoblock C.A.V. fuel-injection pumps are provided for each cylinder bank, and are gear driven, while a fuel lift pump is driven from the free end of the injection pump, overspeed trips being incorporated as standard. An Ardleigh "300" governor is fitted, the particular type varying according to the requirements of the application. Each 12-cylinder engine has one turbo-charger, while the 16-cylinder unit has two.

THREE NEW BRITISH STANDARDS

Standard Code for Flue Gas Analysis

Prepared at the request of the **Ministry of Fuel and Power,** and to assist in raising the general level of combustion efficiency in industry, this new publication (B.S. 3048 : 1958) (74 pp., 19 illustrations) deals with automatic instruments which give a direct indication or record of flue-gas composition. It points out that the analysis of flue-gases from industrial plant serves the following four main purposes: (1) Indicates whether the general conditions for efficient running have been fulfilled. (2) Forms a useful check on the continuance of the above conditions and draws attention to any need for maintenance of the plant. (3) Provides the necessary information for a full heat-balance to be calculated. (4) Indicates the type of atmosphere present in the furnace. The main body of the code deals separately with:—thermal conductivity instruments; instruments depending upon chemical absorption and chemical reaction; viscosity and density instruments; and with gas analysis instruments of recent origin. In addition, there are sections dealing with determination of dew-point, and on kindred subjects such as dust and smoke testing, smoke-density indicators and alarms, etc. Besides pointing out means of effecting economies in the operation of industrial plant, the Code is obviously destined to play a useful part in the application of the Government's smoke abatement scheme. Copies of this publication may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 15s.

* * *

Standard for Steel Tubes

A new British Standard for steel boiler and superheater tubes (B.S. 3059-1958) contains 12 separate and separately numbered specifications: (B.S. 3059/1 to B.S. 3059/12)—six being for carbon-steel tubes, and six for molybdenum steel tubes, of varying form and tensile strength. It thus makes available within one cover, the material formerly dealt with in: B.S. 494. *Cold-drawn seamless mild steel boiler and superheater tubes*; B.S. 512. *Hot-finished seamless mild-steel boiler and superheater tubes*; B.S. 1652. *Seamless half per cent. molybdenum steel boiler and superheater tubes*; B.S. 1653. *Seamless chromium-molybdenum steel boiler and superheater tubes*; B.S. 1654. *Electrically-welded mild-steel boiler and superheater tubes*; and B.S. 1678. *Cold-drawn electrically-welded mild steel boiler and superheater tubes*. Additionally, and to meet the needs of industry—the single volume contains requirements for hot-finished seamless and cold-drawn seamless carbon-steel boiler and superheater tubes (27 tons/sq. in. minimum tensile strength); and for hot-finished seamless and cold-drawn seamless 2¼ per cent. chromium 1 per cent. molybdenum steel boiler and superheater tubes (27 or 31 tons/sq. in. minimum tensile strength). The standard follows the present practice of designing on the basis of the temperature of the metal, as opposed to that of the steam. Temperature limitations on the use of electrically-welded tubes of "rimming" steel are no logner included. Again, and following modern practice, the requirements for percentage elongations have been revised; they are related to an equivalent gauge length of four times the square-root of the area of the test piece, and modifications have been made to the requirements for the expanding test on tube-ends. Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 8s. 6d.

* * *

Gaskets for Pipe Flanges

It is expected that considerable reductions in the present variety of sizes of pipe-flange gaskets will result from the application of a new publication ("British Standard for Dimensions of Gaskets for Pipe Flanges," B.S. 3063-1959), the 24 pages and three figures of which specify "plan" dimensions of gaskets for pipe flanges to B.S. 10, 1770 and 2035.

Essentially dimensional in character, the standard contains many tables, several of which are related to "keyed" diagrams. They have been numbered to conform exactly with the corresponding tables in the appropriate British Standards for flanges. Gaskets which conform to the standard may bear an identification mark incorporating B.S. number, table reference and nominal size, for example: "B.S. 10, Table A. 6-in." Copies of this Standard may be obtained from the British Standards Institution, sales branch, 2, Park Street, London, W.1. Price 6s.

NEW PUBLICATION

A revised and enlarged edition (the 8th) of "Principles and Practice of Flow Meter Engineering," by the late Lee K. Spink, has been published by Foxboro-Yoxall Ltd. The work is arranged in five parts, Part 1 dealing with flow measurement devices, the theory of the differential-type meter, the installation of primary devices, meter mechanisms and choice of head meter specifications. Parts 2, 3 and 4 deal with liquid, steam and gas flow respectively. Each part follows the same general pattern, discussing the installation of flow meters, methods of calculation and chart computation. Throughout, the text is supported by charts, equations and tables. The final section contains a reliable index, a very complete bibliography, a metric units supplement and an appendix containing lists of working equations grouped for ready reference. In the present edition, where necessary, symbols have been changed to agree with A.G.A. and A.S.M.E. terminology. In conformity with the modern practice Reynolds' numbers corrections have been based on line size, i.e., RD is a function only of flow rate and not of orifice diameter/pipe diameter ratio (d/D). In addition to these revisions a number of new items appear. These include a discussion of meter functions and mechanisms, illustrated by simple line sketches of the various types of measuring, controlling and transmitting mechanisms. There is a very complete presentation of data on radius taps, Dall tubes and eccentric, segmental and quadrant edge orifices. Basic orifice factors for 2-½ D and 8 D taps, following the A.G.A. Report No. 3 are listed. A new chapter outlines the basic conditions for gas measurement contracts. The book, which contains some 550 pages is available, price 108s., from the company at Redhill, Surrey.

* * *

Mr. D. D. Morrell, managing director of the Mitchell Construction Co. Ltd., has been appointed a director of Mitchell Engineering Ltd.

* * *

After nearly 47 years' service with the British Thomson-Houston Co. Ltd., **Mr. C. H. Chaplain,** manager of publicity department, has retired. He is succeeded by **Mr. H. G. Harlow,** who has been manager of the BTH Newcastle District Office since May, 1955.

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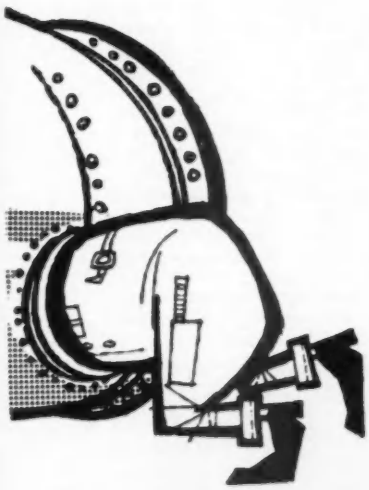

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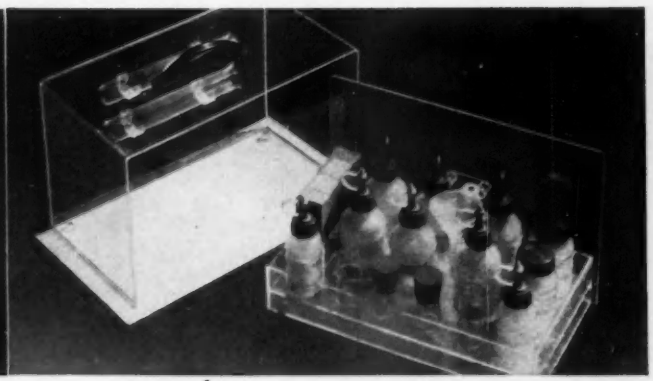

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RECENT Equipment AND Accessories

Compressor for supersonic wind tunnel

A compressor manufactured by the A.E.I. Heavy Plant Division, and which has recently been installed at the College of Aeronautics, Cranfield, is claimed to incorporate a number of interesting features. It operates at variable speed over a wide range of pressure ratios to provide varying Mach numbers in a small high-speed supersonic wind tunnel, which is used for experimental and instructional purposes by the staff and students at the college. The compressor had to be designed for use with two existing 550-h.p. d.c. motors driving in tandem through speed-increasing gears, providing a maximum speed of 8,000 r.p.m. for the compressor. The aerodynamic solution to this problem was found by providing a double-flow and single-flow path for the air within a single cylinder, the first stage of compression thus being accomplished by a double-flow impeller followed by two single-flow impellers, with intercoolers introduced between the first and second stages of compression. This arrangement is adopted to permit the advantage of reducing the rotor end thrust, and therefore the size of balance piston necessary. This minimises the amount of air leakage—which is of particular importance in a wind tunnel application. Another interesting feature of the design is that the compressor casings are of welded-steel construction throughout. (*Associated Electrical Industries Ltd., Heavy Plant Division, Rugby.*)

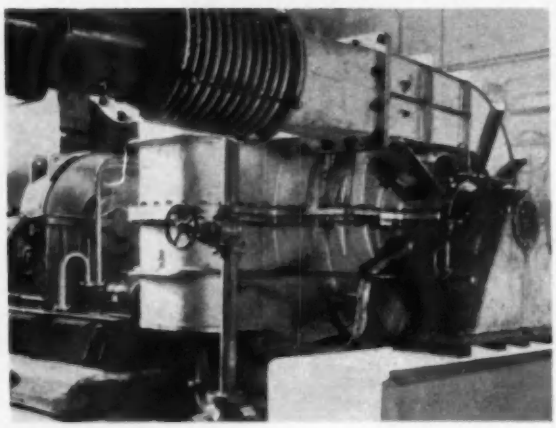


Fig. 1 (left). The compressor supplied by the A.E.I. Heavy Plant Division, and recently installed at the College of Aeronautics, Cranfield. (Associated Electrical Industries Ltd.)

New totally-enclosed motor

Newman Industries Ltd. have recently introduced a new range of totally-enclosed motors with ratings from ¾ to 2-h.p., and in "66"-frame dimensions, which are in accordance with B.S. 2048 and NEMA Standard MG.1. Newman "66"-frame motors are available for single-phase (capacitor start, ¾-1¼ h.p.) or three-phase (1-2 h.p.) operation, and can be supplied for foot, flange, or foot and flange mounting. 1,500 r.p.m. (50 c/s) and 1,800 r.p.m. (60 c/s) are the first speeds to be introduced, but the company point out that other speeds will be incorporated later. The main body of the motor is constructed from heavy-gauge sheet steel, and the two end brackets are of cast-iron. Fan and fan cover are die-cast aluminium for strength combined with lightness. On the single-phase version, a strong cover secured to the frame encloses the condenser, completely protecting it against mechanical damage. For compactness, yet ease of accessibility, the terminal box is incorporated in the drive-end bracket with access through a cover-plate on the top of the motor. Screwed conduit entries are provided on opposite sides, with a blanking-off plug for the entry not in use. Substantial brass terminals, mounted in a moulded terminal-block with permanent markings, are fitted. The single-phase motors incorporate a unique centrifugal switch concealed in the non-drive end bracket, the rotating part of which is built from interlocking steel pressings with no hinge pins or other seizable parts. The static portion of the switch has heavy-duty, solid silver contacts, and is enclosed in a dust-proof moulded case. Thermal overload protection (manual or auto-reset) can also be provided on single-phase motors and provision is made for this to be accommodated in the drive-end bracket. On manual-reset types, the reset button is normally fitted on the left-hand side (viewed from the drive end) but it can be fitted on the opposite side if specified. Bearings are of standard metric sizes and are lightly pre-loaded to ensure quiet vibration-free running. All rotors are dynamically balanced. Total enclosure with "blowover" fan cooling means there are no air-passages to become clogged, and the motors can safely be used for applications that would make the use of an open motor undesirable. (*Newman Industries Ltd., Yate, Bristol.*)

Fig. 2 (right). A single-phase type unit from the recently introduced range of Newman Industries "66"-frame motors. (Newman Industries Ltd.)

Improved design for steam/water mixing valve

A basic improvement in the redesigned Meynell steam/water mixing valve is the introduction of a Monel metal clack, which now replaces the original cast nickel-alloy clack. The function of the Monel metal clack is to close on to the Fluon seat in the steamway; and this new material is claimed to provide a much greater working life, leading to obvious economies. The mixing valve control knob is now manufactured from aluminium, instead of the original cast gunmetal. A further improvement is the introduction of phosphor-bronze leaf jets which permit a fine control of water throughout, over a wide range of pressures. Previous jets were either in moulded rubber or brass, materials which rendered the valve less sensitive than the new model. Further advantages claimed for the valve are compara-

tively noiseless running and relatively low cost. Installation and maintenance costs are also less, as no reducing valves are used. The valve is designed to operate on inlet service pressures up to 150 lb./sq. in. steam and 5 lb./sq. in. water, or *vice-versa*.

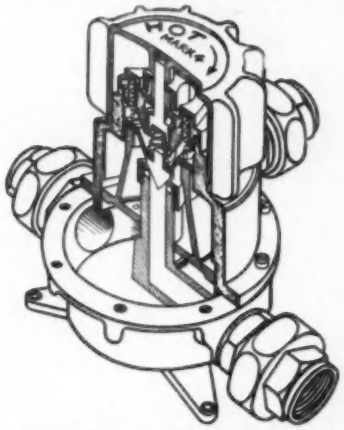


Fig. 3. Sectioned arrangement of the improved design Meynell steam/water mixing valve. (Meynell & Sons Ltd.)

The means of isolating water from steam is positive under "no flow" conditions. Should the water supply fail for any reason, steam is completely shut-off. More than one wash point can be supplied, and these can be at a distance from the valve. This reduces the cost of running steam services to each wash point, and eliminates the need for inlet control valves above each point. The valve is of robust construction, chrome plated and supplied complete with inlet and outlet unions. (*Meynell & Sons Ltd., Montrose Street, Wolverhampton.*)

Instruments for central control systems

The Foxboro-Yoxall Consotrol range of indicators, controllers and recorders has been developed to meet the needs of centralised control systems. Fig. 4 is a close-up of part of a graphic panel recently completed at the company's works, and which illustrates the use of the compact Consotrol instruments in such an application. The instruments shown in the illustration comprise M/54/58 pull-out recorder controllers, M/54 indicators, M/5001 ribbon indicators, M/57 switch and regulator subpanels, and various signal lights and cancellation buttons used in the alarm system. Two M/54/58 pull-out recorder controllers are shown partially withdrawn on the left of the panel. These instruments slide in and out of a sheet-steel housing which is secured to the panel and to which are attached the external connections. These electric and pneumatic connections are of the "plug-in type," and when the unit is withdrawn from the panel, a series of air check valves automatically closes to prevent loss of pressure in the impulse lines. This pull-out feature allows a complete instrument to be replaced with the minimum of interference with the process operation. Another M/54 recorder is shown in the centre of the photograph, with the chart mechanism pulled forward ready for chart changing. On the left of the open instrument is a M/54 indicator, which in all respects is identical to the M/54 recorder except that the chart drive mechanism is replaced by an indicating scale. The parts are interchangeable with the recorder, and all functions, e.g., set-point change and auto-manual transfer, are the same. Several examples of the M/5001 type of ribbon indicator may also be seen. These compact instruments provide a visual indication of process activity by means of a brightly coloured nylon ribbon which rises and falls behind a transparant glass scale in direct relation to increase or decrease of measurement. The instruments are available with single- or double-indicating scales and with high and low or high-low alarm contacts. The two M/54/58 recorder controllers at the top left of the illustration are linked, as part of a cascade control system with M/57 SR switch and regulator subpanels (seen immediately below the two instruments). These small panels provide for manual operation of the control valve and manual setting of the control index from the front of the panel. (*Foxboro-Yoxall Ltd., Redhill, Surrey.*)

Smoke control equipment

Two new items of smoke control equipment available from Photoelectronics (M.O.M.) Ltd., are the smoke alarm, type-CCSA, and the smoke density indicator, type-CCSI. The smoke alarm complies with B.S.S. 2740 : 1956, and provides a visual and audible alarm when smoke emission from a chimney exceeds a pre-set density. A light beam projector unit throws a beam of light across the chimney on to a cadmium photo-electric cell housed in a receiver unit. The photo-electric cell converts the light into electrical energy and as smoke breaks the light beam a varying current is emitted by the cell. This current is strong enough to operate a relay direct, and should the smoke reduce the current emitted by the cell to a point set by the operator, a relay closes and an alarm is sounded. The company's smoke density indicator, complies with B.S.S. 2811 : 1957, and measures smoke passing through a chimney, showing this on a 10-in. scale meter calibrated in percentage of obscuration. As with the smoke alarm, a light beam is projected across the chimney on to a cadmium photo-electric cell, the smoke breaking the light causing the cell to emit a varying current, directly proportionate to the obscuration of the light beam, which as stated above is indicated on the meter. Visual and audible alarms are provided to operate at a pre-set smoke density, and recorders are also available to provide

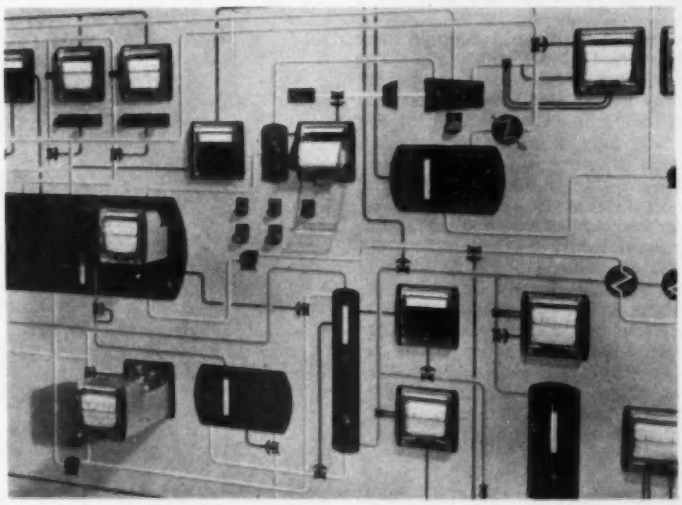


Fig. 4. Part of a recently completed Foxboro-Yoxall graphic panel, which illustrates the use of the compact "Consotrol" range of instruments. (Foxboro-Yoxall Ltd.)

a permanent record of combustion conditions. With both types of equipment the projector and receiver units should be fitted in the chimney, preferably where a negative pressure exists, to assist in keeping the glass windows clean. A transformer should be positioned as near to the projector unit as possible. The control unit is normally sited in the boiler house, and in the case of the type-CCSI equipment the meter is mounted on the boiler instrument panel. [*Photo-electronics (M.O.M.) Ltd., Fotron Works, 63A, Kingston Road, S.W.19.*]

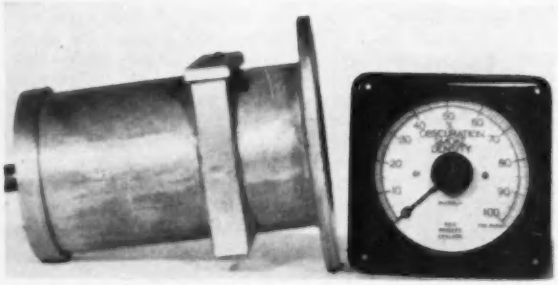


Fig. 5 (left). The projector, type-CCSI, and the 10-in. scale meter. [*Photo-electronics (M.O.M.) Ltd.*]

Oil-firing unit for boilers

New oil-firing equipment, for boilers rated at from 500,000 to 3-million B.Th.U./hr., has been developed by Urquhart's (1926) Ltd. Known as the "MacFire," the new equipment comprises a free-standing cabinet, constructed of resin-bonded fibre-glass, and containing the necessary auxiliary units; a boiler front-plate assembly, also housed in a fibre-glass cover; and a complete set of pipework for the necessary site connections. The auxiliaries contained in the cabinet comprise an electric motor for driving an air-compressor, fitted with an air intake silencer, and which is directly coupled to a volumetric fuel metering pump. The pump has a hand adjustment so that it may be set for the particular fuel rate required, and maintained at this rate irrespective of fuel temperature, suction or pressure heads. There is a built-in fuel filter. A pneumatic cut-off valve safeguards the flow of oil in the event of air-pressure failure. The main feature of the control system wiring is a printed circuit, to which is connected the electric motor starter, a motor which controls the cycle of operations and the flame-failure relay circuit. Also incorporated is an h.t. transformer for the ignition system. The boiler front assembly houses the radiation toe heater, which eliminates a line heater for pre-heating the oil fuel. A built-in 40 or 75-watt heater provides a small reservoir of pre-heated fuel for instant starting from cold. Fine atomisation of the oil is obtained with a medium-pressure air system (8 lb./sq. in.), ensuring complete combustion immediately from starting up. Also in this housing is an automatic pull-back device which withdraws fuel from the atomiser orifice on "shut-down" to prevent any excess fuel leaking away. A built-in photo-conductive cell for flame-failure control eliminates the conventional amplifier section and energises the relay in the cabinet unit. The higher noise level inherent in M.P.A. systems is suppressed by a front-plate cover acting as an attenuator.

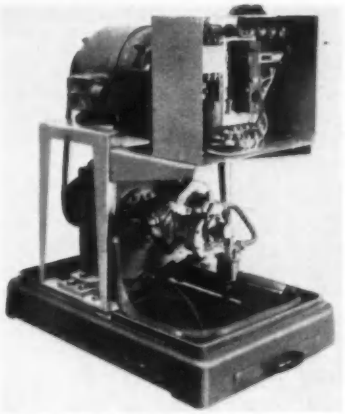
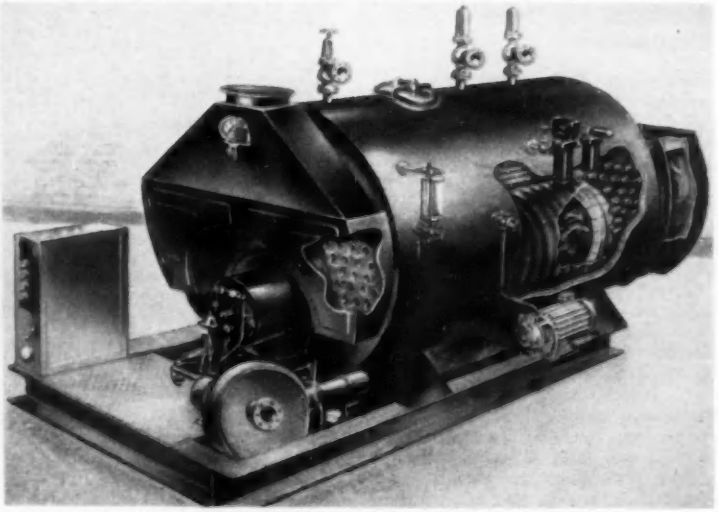


Fig. 6 (right). The cabinet unit associated with the "MacFire" oil firing equipment, with fibre-glass cover removed. [*Urquhart's (1926) Ltd.*]

A water thermostat to control the unit from a preset temperature requirement is also provided, while for steam boilers of equivalent rating this item is replaced by a pressure switch. The equipment conforms to B.S.S. 799, and is suitable for use with fuel oil having a nominal viscosity of 200 sec. Redwood No. 1. At the present time, seven "MacFire" units are available, the three largest units being fitted with a "stage start" device which allows the unit to burn at half-rate for a short period while full-rate fuel flow is achieved smoothly and safely. [*Urquhart's (1926) Ltd., 5, Wadsworth Road, Perivale, Middlesex.*]

NEW RANGE OF "PACKAGED" ECONOMIC-TYPE BOILERS

Frederick Kay (Engineering) Ltd. Nashleigh Works, Chesham, Bucks., have recently introduced a range of fully-automatic, "packaged" Economic-type boilers, available as two-pass units with capacities from 1,000 to 3,000 lb./hr., or alternatively three-pass units with capacities from 2,000 to 10,000 lb./hr. The new boilers comply with the appropriate British Standard Specifications, and their design and methods of manufacture have the full approval of the Associated Offices Technical Committee, acting on behalf of the leading insurance companies. The largest



Impression of a Kayenco 2-pass, Class 1 "packaged" boiler of 1,500 lb./hr. capacity and for a working pressure of 100 lb./sq. in.

capacity unit in the range has overall dimensions of 18-ft. 3-in. long, 9-ft. wide and 11-ft. 6-in. high, while the actual boiler dimensions are 7-ft. 6-in. diameter by 14-ft. 3-in. long. Standard working pressures are 100 lb./sq. in., although units can be supplied for lower working pressures. Heating surface ratings do not exceed 4,500 B.Th.U./sq. ft. in the two-pass units, which figure is slightly higher for the three-pass boilers due to higher gas velocities through the tubes. Throughout the range, the boilers are provided with medium-pressure air, heavy fuel-oil burners, while gas or combination oil/gas firing equipment is available if required. A centrifugal-type feed-pump of Worthington-Simpson Limited manufacture is fitted as standard, while injectors, or an additional feedpump of either the centrifugal or reciprocating type can be supplied as an optional extra. Twin "Mobrey" automatic water-level controls are provided, together with the necessary controls for fully-automatic operation which are contained in a control cabinet. Adequate combustion chamber refractory surfaces, and the necessary insulation material, are supplied integral with the boiler. The company also manufacture the L.R.-series of boilers for space-heating and hot-water supplies to both domestic and commercial premises, which are available in a range of capacities from 65,000 to 500,000 B.Th.U./hr.

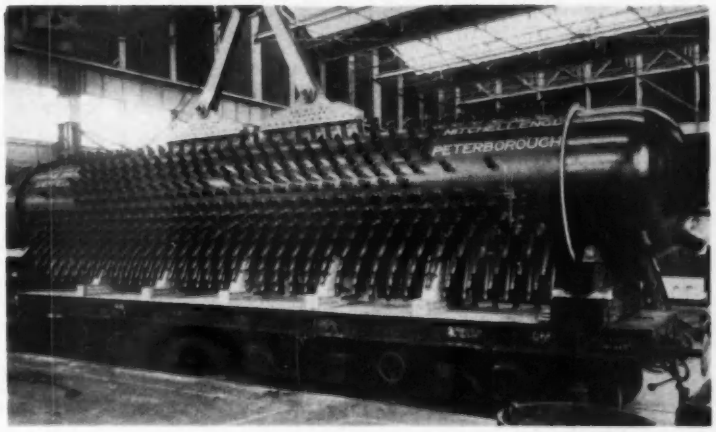
Unusual Steam Drum

The somewhat unusual boiler steam-drum shown in the accompanying illustration was manufactured by Thos. Firth & John Brown Ltd., Sheffield, to the order of Mitchell Engineering Ltd., for a boiler at Skelton Grange "B" power station in the Yorkshire Division of the Central Electricity Generating Board.

The drum was loaded on Friday, January 23rd, at the Atlas Works of Firth Brown, Sheffield, on a special 100-ton capacity railway flat bogie wagon—the only one of its type in this country—and arrived on the Skelton Grange sidings on Monday, January 26th. This 85-ton drum, 47-ft. long, has an internal bore or diameter of 5-ft. 6-in., is fitted with 879 welded stub-tubes and attachments instead of the usual expanded boiler tubes, varying from 9 to 27-in., and was made for a design pressure of 1,850 lb./sq. in. This drum was constructed from two hollow-forged steel half-drums, each with an integral closed end, the two halves then being joined together with a centre circumferential weld seam 5¼-in. thick. The evaporative capacity of the boiler unit will be 860,000 lb./hr., the steam being supplied to a 120-MW turbo-alternator set being manufactured by C. A. Parsons & Co. Ltd., and designed to operate with steam conditions of 1,600 lb./sq. in. and 1,010 deg. F., with reheat to 1,005 deg. F.

An important contribution towards cleaner air, particularly in so far as the smokeless operation of industrial boiler plant is concerned, is being made by a newly-established engineering concern which is now manufacturing under licence smoke eliminators designed and developed by the Fuel Research Station of the Department of Scientific and Industrial Research. Apart from ensuring that smoke emitted conforms with statutory obligations under the Clean Air Act, the installation of these new eliminators is claimed to effect substantial savings. Two types are currently available—one for natural-draught hand-fired boilers, and the other for similar boilers with forced draught. The company is also marketing a new smoke density indicator, also developed by the Fuel Research Station of D.S.I.R., which is said to provide a simple, efficient and immediate means of detecting the emission of dark smoke. Further information is available from **Lynward Engineering Co. Ltd.**, 180, Brompton Road, London, S.W.3.

The forged-steel boiler drum for Skelton Grange "B" power station.



Recent impressive increases in the demand for the sintered metal products of **The Morgan Crucible Co. Ltd.** have led to a move to larger premises. The sales office has been moved to Wandsworth Works, Point Pleasant, Wandsworth, London, S.W.18, and a new factory and laboratory established there for the production and development of "Sinterlink." This combines plant and facilities previously situated at Battersea, and Norton, Worcester. Phase I of the move has now been completed and has been carried out without interruption of output (in fact, output has been stepped up). When the next and final stage is completed—by the middle of the year—production capacity will be available on a much increased scale. The need for these increased facilities has been largely dictated by the rapidly expanding employment of "Sinterlink" sintered metal clutch facing material for heavy-duty machinery in such fields as earth-moving equipment, machine tools, industrial engines, marine engines, cranes, tractors and mechanical-handling equipment. Morgans, with their great experience of powder metallurgy, have indeed pioneered the production of sintered metal clutch facings in this country, thus solving many of the operational, maintenance and design problems frequently met with in connection with modern power transmission and control.

* * *

Mr. C. R. Jones and **Mr. P. K. Richards** have been appointed as directors of John Thompson Water Tube Boilers Ltd. Mr. Jones has been with the company since 1928, and, as head of the constructional department, was responsible for the recent installations of steam-generating plant at Marchwood, Tilbury and Bold "B" power stations of the Central Electricity Generating Board. He is currently supervising the erection of equipment for the Board's nuclear power station at Berkeley. Mr. P. K. Richards, B.Sc., A.M.I.Mech.E., joined John Thompson Water Tube Boilers in 1948 and was promoted to be head of the liaison department in 1951, with responsibility for co-ordinating the projects and contracts departments. He became nuclear contracts manager in 1953, and was identified with the manufacture, by John Thompson Ltd., of the fast-breeder reactor vessel, and the primary and secondary heat-exchanger pipework for the Dounreay experimental fast-breeder reactor station. More recently, he has been concerned with equipment which the John Thompson Group are making for Berkeley nuclear power station.

* * *

Two new leaflets, one (No. 173) describing "SD" turbine-driven feed pumps, and the other (No. 155) "QB" turbine-driven feed pumps, are now available from **G. & J. Weir Ltd.**, Cathcart, Glasgow. The "SD" series are recommended for duties where feed-water temperatures do not exceed 250 deg. F., while the "QB" series are designed to be suitable for the most rigid temperature and pressure requirements of medium and high-pressure marine boilers, and for conditions demanding minimum steam consumption.

OVERSEAS Steam Engineering Practice

Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment

Indirectly - heated air preheater

The indirectly-heated air-preheater arrangement shown in Fig. 1, is of the type in which water is circulated through a tube bundle (c) located in the flue-gas pass of a boiler after the economiser (b). This water, which is circulated in closed circuit by means of a pump (e) is used to transfer heat to the air in the air-heater (d). The air-preheater tubing is of the fin-tube type. Assuming a water temperature of 140 deg. C. (284 deg. F.) at the air-heater inlet, and a water temperature of 70 to 80 deg. C. (158 to 176 deg. F.) at the air-heater outlet, the combustion air can be preheated to 120 deg. C. (248 deg. F.). This arrangement was developed some ten years ago and is still used in Swedish industrial plants. Its advantages are—that leakage of air from the air side into the flue-gas side of the air-preheater is absent, and that because of the relatively high exit temperature of the water from the air-heater, corrosion on the air side cannot occur. Preheaters of this type can be built for water temperatures up to 200 to 220 deg. C. (392 to 428 deg. F.). A mixed system installed in a boiler of 176,000 lb./hr. steam output is shown in Fig. 2. In this case it was not possible to use the flue-gas heat content available for water preheating without incurring steaming. In addition to the indirect air-heater system comprised of the tube bundle (c), the air-heater (d), and the circulating pump (e), a flue-gas type air-preheater (g) is provided which heats the air to a final temperature of 240 deg. C. (464 deg. F.). Here again, the water temperature at the air-heater outlet is 80 deg. C. (176 deg. F.) so that the danger of corrosion is excluded. A disadvantage of this arrangement is its relatively high cost. In the latest design, shown in Fig. 3, the circulating-water of the first-stage leaves the air-preheater at 80 deg. C. (176 deg. F.) and is heated in the tube bundle (c) to 100 deg. C. (212 deg. F.). It is then introduced into the feed-water stream which is at a temperature of 100 deg. C. (212 deg. F.). at the suction side of the feedpump supplying the economiser (b). The water exit temperature can thus be as high as 220 deg. C. (428 deg. F.) depending upon the boiler pressure and flue-gas inlet temperature at the inlet side of the economiser. Water at 220 deg. C. (428 deg. F.) for supply to the indirect air-heater is drawn off at the economiser outlet. In this way, an air temperature of 200 deg. C. (392 deg. F.) can be obtained. By controlling the amount of water drawn off at the economiser outlet, a degree of flexibility is achieved, which facilitates temperature equalisation. An important advantage of this system is that the total flue-gas-swept heating surface is smaller than would be required for a system employing a flue-gas-heated air-preheater. (*BWK*, Vol. 10, December, 1958, pp. 569/571.)

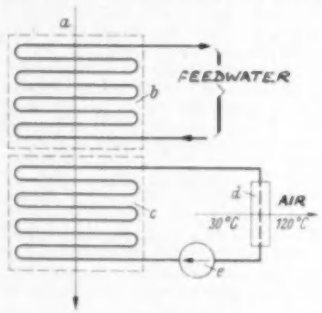


Fig. 1 (above). Diagrammatic arrangement of an indirect air preheater.

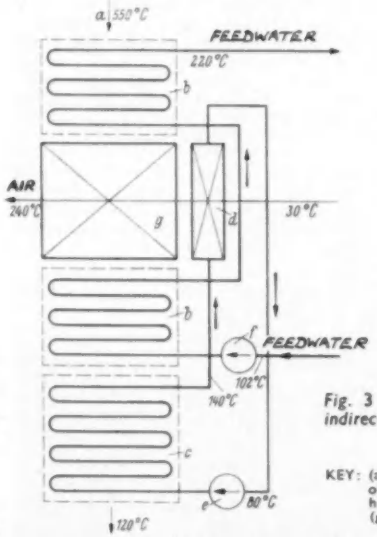


Fig. 2 (right). Diagrammatic arrangement of a combination flue-gas air-heater with indirect air-heater.

Automatic washing of air-preheaters

Water-washing of the horizontal-shaft air-preheaters at the Linden power station of the Public Service Electric & Gas Co. of Newark, New Jersey, U.S.A., while the boilers are still in service, is now stated to be a regular practice. The washing system operates on a semi-automatic cycle during off-peak hours, and allows the washing of one preheater at a time. Filtered water is heated to 180 deg. F. by a steam injector, and then pumped at a pressure of 200 lb./sq. in. to two nozzles—one in the preheater air inlet and one in the outlet. The washing action

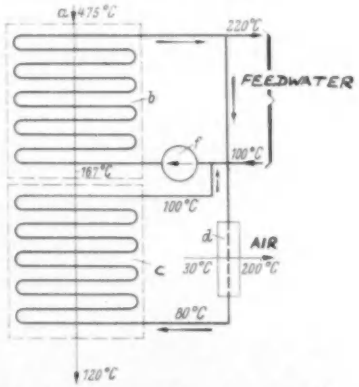


Fig. 3 (above). Diagrammatic arrangement of an indirect air-heater with circulating water passing through economiser

KEY: (a) Flue gas entry; (b) Economiser; (c) Water heater of indirect air-heater; (d) Fin-tube type indirect air-heater; (e) Circulating pump; (f) Feedwater pump; (g) Flue-gas type air-heater.

comprises high-velocity jets, spraying as the nozzles move across the radius of the preheater. Automatic timers control the nozzle movement, and also delay the air inlet washer nozzle starting, so that the nozzles are not aimed at each other. During periods when washing is being carried out, the motor driving the rotary air-heater is used to allow speed adjustment. The timers and also the air-heater motor are adjusted to correct any inherent speed variations in the nozzle positioner. As the washing cycle progresses, periodic checks are made of the drain water pH in order to ascertain how effective the wash has been. At the start of the cycle the readings are around 2.6 pH, and they gradually increase as the wash continues. In addition, visual inspections and pressure-drop readings are made. Pressure-drop readings are the final check as to the effectiveness of the operation, and the means of deciding when the next wash should take place. Experiments are still in progress on washer nozzle design in an attempt to reduce the time required for the washing cycle. Satisfactory washing depends on a nozzle capable of providing a high-velocity stream, which will overcome gravity pull and carry through the heater elements. Large quantities of water are required, and to speed up the cycle, the need is for a nozzle which will give high velocity and increased coverage. With improvements in nozzle design, it is hoped that it will be possible to carry out the complete cleaning of one preheater in approximately four hours. (*Power*, Vol. 102, No. 11, pp. 110-111.)

The first meeting of the board of directors of **A.C.C.-Vickers-Babcock Ltd.** was held on January 19th at its registered office at Adelphi, Queens Road, Bombay. This company has recently been formed in the State of Bombay under the Indian Companies Act, 1956, with a nominal capital of Ten Crores of Rupees. The shares are held in the proportions as:—Associated Cement Companies of India (A.C.C.) 49½ per cent., Vickers Ltd. 24½ per cent., Babcock & Wilcox Ltd. 24½ per cent., and other Indian interests 1 per cent. The chairman of the new company is Mr. Dhramsey Mulraj Khatau, who is also chairman of A.C.C. and a director of a number of Indian undertakings. There are eleven other directors. A large works is to be built by the new company at Durgapur in West Bengal, for the manufacture of heavy engineering products such as cement-making machinery, boilers, pressure-vessels, winders for the mining industries and other engineering products. Technical assistance will be provided by the three main shareholders. Construction on site will begin shortly, and it is expected that actual production will begin in 1962.

* * *

A contract, valued at over £200,000, has been placed with the **General Electric Co. Ltd.** for the supply of two turbo-blowers for the furnaces at the new works of the South Durham Iron & Steel Co. Ltd., West Hartlepool. The blowers are similar in design to those being manufactured by the G.E.C. for the Broken Hill Proprietary Co., Australia, and for the ISCON Steelworks, at Durgapur, India. Each will have an output range of 80,000 cu. ft./min. at 25 lb./sq. in., to 100,000 cu. ft./min. at 20 lb./sq. in. The turbines will operate with steam conditions of 185 lb./sq. in. and 585 deg. F., and a vacuum of 28-in.

* * *

A new gloss paint has been introduced by **C. R. Averill Ltd.,** Alyn Mills, Caergwrle, Wrexham, North Wales, under the trade-name "Bryte-Wear." Applications recommended by the manufacturers include the painting of machinery, vehicles, works maintenance and decoration, and in addition it can be used as a low-bake stoving enamel. The paint can be applied by brush or spray, and it is claimed to dry within two hours to a tough glossy film. A colour-card and technical information sheet (No. 16) are available from the manufacturers.

Mervyn Instruments, Woking, Surrey, have enlarged their marketing organisation by the appointment of the following:—**Mr. V. M. Farrant,** M.Inst.Pet., as sales promotion manager, **Mr. P. M. Bartlett,** B.Sc.(Eng.), as divisional sales manager, and **Mr. J. A. Shelton** and **Mr. A. E. Deslandes** as technical liaison officers. Mervyn Instruments are well known for developing scientific instruments from the application of electronic, mechanical and optical skills, in co-operation with A.E.R.E., C.E.R.L., W.P.R.L., and other such bodies. Mr. Farrant and Mr. Bartlett are at present concerned with the introduction of a new and extended range of Mervyn scientific instruments, such as the new Infra-red Spectrometer, the Square Wave Polarograph Mk. III, the sulphur-dioxide recorder, gas-mixing unit, and several other new projects, for the chemical, petroleum and heavy industries of this country and overseas.

* * *

British Boiler Accessories Ltd. announce that they have secured their first order in Canada for a steam accumulator for a new brewery being constructed for Carling Breweries Ltd., at Etobicoke, Toronto. The accumulator will be charged from water-tube boilers, which are fired by natural gas, and the accumulator will be capable of storing 26,600 lb./hr. of steam when working at pressures between 200 lb./sq. in. and 45 lb./sq. in. Initial economy in the construction of the plant using an accumulator is that two 36,000 lb./hr. water-tube boilers will be purchased instead of two 47,000 lb./hr. units, which would have been necessary without the provision of an accumulator.

* * *

To meet the increased demand for Dohmfrac pre-coated resin sand for shell moulding and shell core production, a third manufacturing plant is now in full production at the Burslem, Stoke-on-Trent, works of Mellor Mineral Mills—one of the **Dohm Group of Companies.** Known as the No. 3 Plant, the new premises now permit large batch production of the material.

* * *

A new publication from **Winn & Coales Ltd.,** Denso House, Chapel Road, London, S.E.27, contains a description of Denso Mastics—a group of permanently resilient cold-filling and jointing compounds—together with details of a few of the varied applications for which each product is best suited.

Lancashire Dynamo announce the appointment of **Mr. R. A. Bent,** A.M.I.E.E., A.M.Brit.I.R.E., to the board of Lancashire Dynamo Holdings Ltd. Mr. Bent is managing director of Lancashire Dynamo Electronic Products Ltd., Rugeley, a company of which he was one of the founders, in 1946.

* * *

Metropolitan-Vickers Electrical Co. Ltd. announce that **Mr. J. W. Potter,** A.C.I.S., A.A.C.C.A., has been appointed secretary of the company. Formerly assistant secretary, Mr. Potter succeeds **Mr. D. Thomson,** who has retired.

* * *

It is with regret that we record the recent death of **Mr. T. A. Hammersley,** joint managing director of Marco Conveyor and Engineering Co. Ltd. Mr. Hammersley was 64, and had been with the Marco Company for over 30 years.

* * *

Mr. R. Edwin McAlpine has been elected chairman of The Nuclear Power Plant Company Limited, in succession to the late Sir Claude D. Gibb.

* * *

Fielden Electronics Ltd. have formed three new sales divisions, viz.:—London, the North-East and the Midlands. **Mr. R. Speller,** after three years as company representative in London (North), becomes manager of the London Sales Division; **Mr. F. G. Totty,** formerly Yorkshire representative, becomes North Eastern sales division manager, based on Stockton; and **Mr. F. B. Price,** for many years Fielden representative in the Midlands, assumes the management of the Midlands sales division.

* * *

Auto-Klean Strainers Ltd., Lascar Works, Hounslow, Middlesex, have recently published a new brochure entitled "Auto-Klean for Oil-Firing," which describes Auto-Klean filtration in the field of oil-burning equipment. The particular requirements of oil-fired plant operating on all grades of fuel are examined for a wide variety of applications, including steam generation. The construction and operation of Auto-Klean self-cleaning filters are described, together with comprehensive instructions for their installation and maintenance. Also included are specification tables giving detailed information of flow rates, pipe connections, and overall dimensions of the standard range of Auto-Klean self-cleaning filters.

Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Boiler with gas recirculation

A boiler designed to include a gas recirculation system is shown in Fig. 1, where the furnace (10) is arranged to be fired by burners (42) positioned in vertically spaced, horizontal rows at the wall (12). The furnace gases after leaving the outlet of the gas-pass for the secondary superheater (34) enter the turning space (44) at the top of a downflow gas-pass having a rear wall (45). In this gas-pass the gases flow over banks (46, 47, 48 and 49) of spaced tubes forming a primary superheater. Beyond the primary superheater the gases pass over a bank of tubes (60) constituting an economiser and then through a duct (62), which is connected by way of an air-heater (78) to a stack, and by a side connection to the inlet duct (64) of a re-circulated gas system. This system includes a

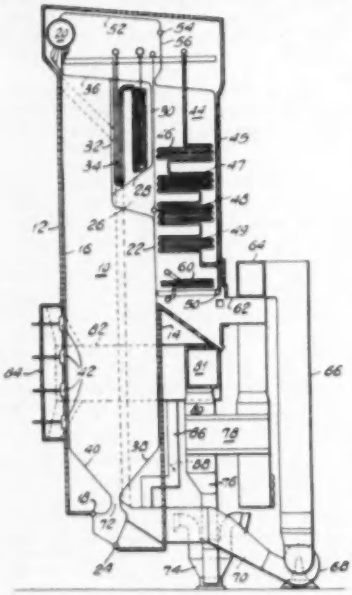


Fig. 1. British Patent No. 806,917.

duct (66) leading to the inlet of a recirculating gas fan (68), the outlet of which is connected by duct (70) to openings between the lower parts of tubes (22), at the throat (72) of the hopper bottom of the furnace. The unit has a forced draught fan (74), the outlet of which is connected by duct (76) to the air-heater (78). The air outlet of the latter is connected by the duct components (80, 81 and 82) to a wind-box (84) for supplying heated air to the air-flow registers of the burners (42). From the duct (82) a by-pass duct (86) leads downwardly. This duct is provided with a damper (88), and connected to the duct (70) of the recirculated gas system, as indicated in Fig. 2. Fig. 2 is a diagrammatic arrangement of an air-gas flow system having a recirculated gas system as applied to a boiler, generally similar to the unit shown in Fig. 1 and in which the recirculated gas fan (68¹) has its inlet connected by a duct (66¹) to the gas outlet of a boiler (90). Recirculated gases from the outlet of the fan flow through the duct (70¹) to a position (72¹) in the boiler (90), the position (72¹) corresponding generally to the position of recirculated gas entry at throat (72) of the unit shown in Fig. 1. A forced-draft fan (74¹) delivers air through duct (76¹) to the air-heater (78¹), from which the heated air flows through the duct (82¹) to the wind-box (84¹). The flow of air from the forced-draught fan (74¹) through the duct (76¹) is regulated by the damper (92), and heated air flowing from the air-heater (78¹) to the burners is subjected to control by the dampers (94 and 96); control of air flow to the burners is also subject to the operative influence of a by-pass (98) communicating with the duct (82¹) at a position below the air heater (78¹), and leading to the inlet duct (100), which communicates with the inlet of the forced-draught fan (74¹). Control of air flow through this by-pass circuit is subject to the positioning of dampers (102 and 104). From a position along the duct (76¹) the by-pass duct (86¹) leads to the outlet duct (70¹) of the recirculated gas system, the flow through this by-pass being subject to control by the damper (88¹). The heating gases after passing over the air-heater (78¹) to the part (108) of the unit flow through a stack (110) to atmosphere. A control damper (112) in the duct (66¹) is subject to a number of controls, one of which is exerted by a differential pressure controller (114) having opposite sides of its pressure responsive element connected to the duct (66¹) at the inlet and outlet sides of the damper (112). This control is automatically operated to tightly shut the damper (112) to prevent gas flow through the fan (68¹) when the differential between the pressure at the inlet of the tube

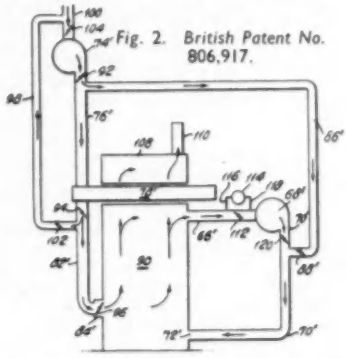


Fig. 2. British Patent No. 806,917.

(116) and the pressure at the inlet of tube (118) is less than a predetermined value. Damper (112) is also subject to a motor current control responsive to the current flowing through an electric motor for driving the fan (68¹), and this control operates at loads above a predetermined value, i.e., one-half full rated electric current load, to render the differential pressure switch control inoperative. During operation of the fan motor at loads below the aforementioned electric current value, the differential pressure switch is operative. A third control for the damper (112), and, therefore, of the recirculated gas flow, and the final steam temperature, is provided. This control is responsive to changes in steam flow, to changes in the final steam temperature at the outlet of the secondary superheater, and to a factor involving the product of gas mass flow across the superheater, and gas temperature. These operative influences act conjointly to vary and control the recirculated gas-flow so that final steam temperature may be maintained at a predetermined value over a wide range of steam demand. *British Patent No. 806,917 issued to Babcock & Wilcox Ltd. Complete specification published January 7th, 1959.*

Waste-heat boiler

Waste-heat boilers installed behind open hearth and other types of furnaces are frequently provided with stand-by furnaces. The different methods of operation, utilising waste-heat, oil or gas firing, result in widely differing conditions of gas temperature, flue gas volume and draught loss in the boiler. Thus, for example, with the same steam generation, when operating with waste-heat only, the flue gas quantity and the draught loss will be considerably greater, and the flue gas temperature before a superheater in a gas flow path leading from a stand-by furnace will be considerably lower than when operating with only this furnace, irrespective of whether it is fired by oil or gas. For this reason difficulties result in the operation of such waste-heat boilers, since the temperature of superheat and the gas outlet temperature are subject to considerable fluctuations and the superheater is overloaded when operating with the stand-by furnace only. A waste-heat boiler in accordance with this invention includes a stand-by or auxiliary furnace, an induced-draught fan, gas recirculating ducting, to effect recirculation to the combustion chamber of the stand-by furnace of gases discharged by the induced draught fan, and dampers for controlling the flow of gases through the recirculation ducting. Where a superheater is disposed in the gas flow path leading from the stand-by furnace, gases are recirculated to the furnace chamber when the stand-by furnace is in operation, and the rate of recirculation is controlled so as to regulate the superheated steam temperature. The waste-heat boiler shown in Fig. 3 is provided with a stand-by furnace (1), and an induced draught fan (2) is normally swept by waste gases which reach the boiler through a duct (3). In a given case these gases may amount to 18,000 cu. metres/hr. (635,580 cu. ft./hr.) at N.T.P. and be at a temperature of 600 deg. C. In order to pass these gases through the waste-heat boiler, the induced draught fan (2) must overcome a draught loss of 130 mm. (5-in.) water gauge and be dimensioned accordingly. If, however, waste gases are not available and the boiler is fired by the stand-by furnace (1), much smaller flue gas quantities of a magnitude of approximately 6,000 cu. metres/hr. (211,860 cu. ft./hr.) at N.T.P. result when burning the required quantity of fuel in the furnace for the corresponding boiler output. Despite the heat transfer by radiation to the wall cooling tubes (5) of the stand-by furnace the hot gases generated in that furnace would sweep the superheater (4) at a temperature of 900 to 1,000 deg. C. as against about 500 deg. C. under waste-heat operation. However, by means of gas recirculation ducting (6) leading from the outlet branch of the induced draught fan, cooled gases are admitted, under the control of a damper (7) in the ducting, through recirculating openings (8) in front of the superheater (4). The quantity of these gases will be such that the flue gas volume and its temperature are approximately the same as when operating with waste-heat only. The flue gases cooled to about 200 deg. C. flow automatically from the outlet branch of the induced-draught fan, where there is a sub-atmospheric pressure of approximately 20 mm. ($\frac{3}{4}$-in.) water gauge, to the combustion chamber of the boiler where a sub-atmospheric pressure of, say, 60 mm. ($2\frac{3}{8}$-in.) water gauge obtains. With this method of operation, approximately the same flue gas quantity will always impinge on the heating surfaces of the waste-heat boiler in the gas flow path leading from the stand-by furnace, and the gas temperature at the outlet from the stand-by furnace will remain at about the same level. For the required gas recirculation a second fan is not required, and the existing induced-draught fan can be operated with the same output and efficiency as during normal waste-heat operation. *British Patent No. 807,059 issued to Babcock & Wilcox Ltd. Complete specification published January 7th, 1959.*

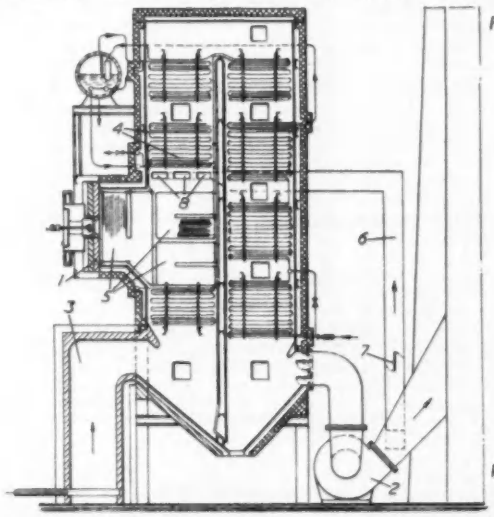


Fig. 3 (left). British Patent No. 807,059.

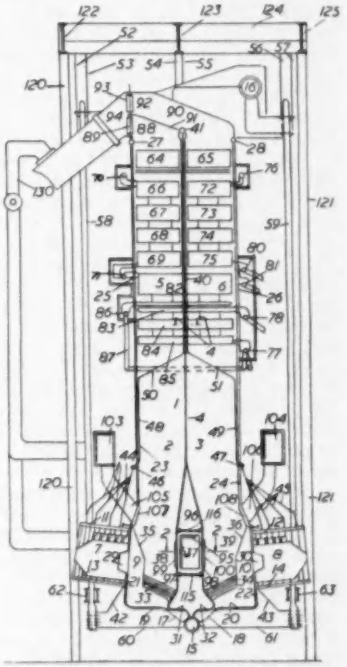


Fig. 4 (right). British Patent No. 807,282.

High pressure steam generator

The high capacity steam generator and superheating unit shown in Fig. 4 comprises an upright chamber (1) with radiation chambers (2 and 3) disposed side by side, and separated by the wall (4). The radiation chambers lead upwardly to parallel passes comprising a superheater pass (5) and a reheater pass (6). At opposite sides of the unit are placed respective rows of cyclone furnaces (7 and 8). At the upper ends of the parallel gas passes (5 and 6) are arranged sections (64 and 65) of an economiser, suitably connected in the feedwater supply to the unit. In the gas pass (5) below the economiser section (64) are arranged the sections of the primary superheater

comprising banks (66, 67, 68 and 69) which are connected in series between an upper inlet header (70) and a lower outlet header (71). In the gas pass (6) below the economiser section (65) are arranged the sections of a reheater comprising banks (72, 73, 74 and 75) which are connected in series between an upper inlet header (76) and lower outlet headers (80 and 81). Below the sections of primary superheater and reheater, and extending across both the superheater and reheater passes, substantially from the side wall (25) to the side wall (26) of the unit, is a further section of the primary superheater comprising a bank (82). The limbs of the tube coils are widely spaced relative to the tubes of the wall (40) and are arranged to pass through the wall (40). The upright tubes of the wall are displaced out of alignment to allow the passage of the limbs of the superheater elements. The upper ends of the bank (82) of the superheater is connected to the header (71), and the tubes at the bottom of the bank terminate in a header (86) leading to a spray-type attemperator (87). Below the section (82) of the primary superheater is provided a secondary superheater constituted by tubes extending across both of the parallel gas passes and comprising vertically spaced banks (83, 84 and 85) of tubes. The lower tubes are connected to a header (77) which is joined to the outlet of the attemperator (87). The upper tubes of the upper bank (83) of the secondary superheater are connected to an outlet header (78) for the supply of superheated steam to the high-pressure stage of an associated steam turbine. The superheater gas pass (5) above the section (64) of the economiser is formed with a lateral gas outlet (88) fitted with a damper control (89), comprising a series of vertically pivoted dampers. The reheater gas pass (6) above the section (65) of the economiser is formed with a lateral extension (90) above the roof (91) of the superheater gas pass, and this extension is provided with an outlet (92) incorporating damper control (93) immediately above the outlet (88) from the superheater pass. The outlets (88 and 92) open to a common outlet duct (94) leading downwardly to an air-heater which is not shown. The steam and water drum (16) and the duct (94) are at opposite sides of the unit. The lower sections (38 and 39) of the radiation chambers extending between the associated secondary furnace chambers (9) and (10) and the intermediate space or chamber (37) is of reduced width. The intermediate space or chamber (37) provides a passageway into which recirculated gas is passed by way of an opening (95) formed in the rear end wall (96) of the unit. In each radiation chamber arrangements are incorporated for gas recirculation which direct respective flows of recirculated gases into the chamber at a downward inclination, and towards the flow from the associated outlet from the intermediate chamber (37). Suitable arrangements are provided for controlling the total rate of gas recirculation to each of the radiation chambers, and to this end dampers are associated with the ducts (103 and 104) and the openings (95). The superheat and reheat temperatures may be regulated over a wide range of loads and safe starting is promoted since all the steam heating surfaces are drainable. *British Patent No.* 807,282 *issued to Babcock & Wilcox Ltd. Complete specification published January* 14*th*, 1959.

Air-preheater

Air-preheaters for operation in conjunction with industrial furnaces have suffered in the past from the lack of a suitable structure using materials of construction that will withstand the high temperatures of the combustion gases discharged by such furnaces. The most popular type of air-preheaters are recuperators, built of refractory shapes, and which may either be continuous or regenerative in operation. The heat transfer characteristics of recuperators are poor and the equipment tends to be large for a given heat recovery. A heat-exchanger for use as an air-preheater in accordance with this invention comprises a section having a chamber, with an inlet for hot furnace gases of a smaller cross sectional area than the chamber, and in which air to be heated is passed through a tube bundle. These tubes are adjacent to the chamber wall and, for the most part, out of contact with the path of flow of the hot furnace gases through the chamber so that they absorb heat primarily by radiation from the hot gases, the air then being led to a second section in which heat is absorbed primarily by convection. The heat-exchanger shown in Figs. 5 and 6 is an air-preheater. A gas intake conduit (13) receives hot combustion gases from a furnace. The conduit (13) has a refractory lining (14) to protect it. A radiant shield section (15) has a chamber (16) of rectangular cross-section, connected to the conduit (13) to receive the combustion gases. The conduit (13) is of smaller area than the chamber (16). All the walls of the chamber (16) are insulated with a refractory lining. A pair of two-limbed manifolds (23 and 24) surround the inlet end of the chamber (16). The inlet manifold (23) has two legs (25 and 26), and the outlet manifold (24) has two legs (27 and 28). Twin banks (30 and 32) of parallel U-shaped air tubes (34 and 36) are arranged in the chamber (16). The adjacent lower ends of the tubes (34) are connected to the leg (25) of the inlet manifold (23), while the adjacent upper ends are connected to the leg (28) of the outlet manifold (24). The tubes (36) are connected between the legs (26 and 27) of the inlet manifold (23) and the outlet manifold (24) respectively. Thus each wall of chamber (16) has at least one row of tubes arranged along it, and the end wall (19) has two rows of tubes where the tubes

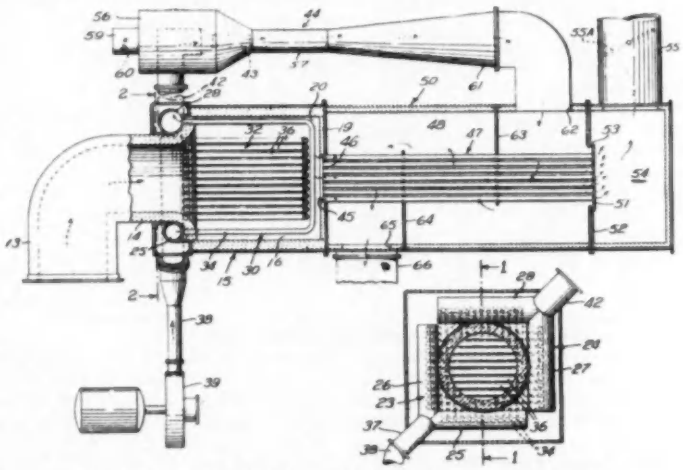


Fig. 5 (above). Fig. 6 (bottom, right). British Patent No. 807,408.

of the bank (34) cross those of the other bank (36). The manifold (23) has an intake conduit (37) connected by a pipe (38) with the discharge side of a low-pressure centrifugal compressor (39). The compressed air passes through the tubes (34 and 36) at a relatively high velocity into the outlet manifold (24) which has a discharge conduit (42) at the junction of the legs (27 and 28) which conducts the air to the nozzle (43) of a jet-pump (44). The air flowing through the tubes (34 and 36), absorbs heat from the combustion gases primarily by radiation, and in flowing at a high velocity prevents excessive overheating of the tubes. An opening (45) is provided in the end wall (19) for a tube sheet (46) to accommodate the inlet ends of a tube bundle (47). This bundle is arranged in a chamber (48) of a convection section (50). The other end of the tube bundle is mounted in a tube plate (51) resiliently supported on a wall (52) by a flexible seal (53). Combustion gases from the chamber (16) pass through the tubes of the bundle (47), and into a plenum chamber (54), from which they are discharged to atmosphere through a stack (55) in which there is a damper (55A). The air passing through the tube banks (30 and 32) has a pressure above atmospheric when it flows from the nozzle (43) of the jet pump (44). The pressure of the air at the discharge side of the compressor (39) is sufficient to compensate for the pressure drops through the intermediate conduits. The nozzle (43) extends into an inlet (56) of the pump (44) and the outlet of the nozzle is arranged in a restricted throat (57). A tube (59) communicates with the inlet (56) which is open to the atmosphere, and a damper (60) is provided to control the flow of air through the tube (59) into the inlet (56). The jet pump (44) operates on the principle of an ejector. The air issuing from the nozzle (43) inspires a large quantity of atmospheric air which flows through the throat (57) and a flared outlet (61). The outlet (61) communicates with the chamber (48) through an opening (62) in the wall of the convection section (50). The air entering the inlet (56) has the temperature of the ambient atmosphere and after mingling with the heated air from the nozzle (43) attains an intermediate temperature. A pair of baffles (63 and 64) extends the flow of combustion air transversely around the outside of the tubes of the bundle (47), countercurrent to the combustion gases flowing in the tubes. The air absorbs heat from the combustion gases in the tubes by convection and leaves the chamber (48) by an opening (65) in the lower wall which communicates with a combustion air supply conduit (66). The arrangement of the tubes (34 and 36) adjacent to wall (19) offers a double-tubular shield for the tube sheet (46). Despite the fact that the temperature of the combustion gas entering the tubes of convection tube bundle (47) is still quite high, the shield intercepts the radiation from the gas mass from directions where the radiant beam is longer. The mean radiant beam length of the gas mass between the double row of tubes and tube sheet (46) is much smaller, so that the intensity of radiation is to a large extent decreased, and overheating and failure of the tube sheet is therefore prevented. *British Patent No.* 807,408 *issued to Foster Wheeler Ltd. Complete specification published January 14th,* 1959.

The boards of **G. & J. Weir Holdings Limited and Catton & Co. Ltd.** announce that the merger of Catton & Co. Ltd. and Weir Foundries Limited (a subsidiary of G. & J. Weir Holdings Limited), previously reported, has now been concluded. A new holding company, Weir-Catton Limited, has been formed, 50 per cent. of the issued capital being held by G. & J. Weir Holdings Limited and 50 per cent. by existing shareholders of Catton & Co. Ltd. Weir-Catton Limited holds the whole of the issue share capital of two operating subsidiary companies, Catton & Co. Ltd., steel founders, Leeds, and Weir Foundries Limited, non-ferrous and stainless steel founders, Thornliebank, Glasgow.

* * *

During the cold spell experienced in the week ended January 17th, the Central Electricity Generating Board's operational system met the highest demand for power yet recorded. For the first time, the demand soared over the 20 million kW figure to reach a record total of 20,900,000 kW, about 28 million h.p. This high demand occurred between 5 p.m. and 5.30 p.m. on Wednesday, January 14th.

* * *

A. M. Lock & Co. Ltd., Oldham, Lancs., are arranging through their Midland sales and service division, the third annual exhibition at Bennett Hall, Snow Hill, Birmingham, of electronic instruments, controls and apparatus, from March 17th to the 20th. More than 400 instruments and controls will be displayed. A number of important new devices will be exhibited for the first time, and, as in previous years, there will be working demonstrations.

Mr. A. H. Woodley, sales manager of Keith Blackman Ltd., and director of Blackman Export Co. Ltd., London and Arbroath, recently completed an extensive tour of clients and agents in the U.S.A. and Canada. Flying to New York, Mr. Woodley's first major stop was at Philadelphia where the 65th annual meeting of the American Society of Heating & Air Conditioning Engineers was being held. This event attracted the leading North American consulting, contracting and manufacturing engineers within the industry. Running concurrently at the Convention Hall, Philadelphia, was the International Heating & Air Conditioning Exhibition which Mr. Woodley also attended. After the Philadelphia stop, Mr. Woodley proceeded on a tight-scheduled sales tour which covered Washington, Louisville, Kansas City, Buffalo and Boston before he travelled north to Montreal for discussions with the company's Canadian agents—Norris Warming Canada Ltd. Included in the Canadian tour were visits to manufacturing and shipbuilding companies in the highly industrialised province of Quebec. In all, Mr. Woodley covered approximately 10,000 miles in this, his fifth overseas sales tour in the last 12 months.

* * *

The Central Electricity Generating Board, Public Relations Branch, Winsley Street, London, W.1, have recently made available a new film entitled "Colin Wills Reports on Electricity." With a running time of some 40-min., the film illustrates, very effectively, the growth of demand for electrical power, and the importance of electricity in the expanding national economy.

Sir W. H. Bailey & Co. Ltd., Patricroft, Manchester, announce that **Mr. S. Watts,** the chief draughtsman, has been appointed chief engineer (contracts division) and that **Mr. B. Scott-Garrett** has joined the company as chief engineer (control division).

* * *

Mr. J. F. Hancock has been appointed assistant superintendent, maintenance department, Metropolitan-Vickers Electrical Co. Ltd. Mr. Hancock received his technical education at the Head Technological College, Dublin. After serving an apprenticeship in mechanical engineering, he held positions with various firms, in each case on the works engineering side. The last of these, prior to his joining Metropolitan-Vickers in 1958, was with the Dayton Corporation, of Dayton, Ohio, for whom he was responsible as plant engineer for the development and maintenance of their new factory in Scotland.

* * *

Metropolitan-Vickers Electrical Co. Ltd. announce the appointment of **Mr. B. Dawkins,** B.Sc.(Eng.), A.M.I.E.E., as assistant manager of the Education Department for Professional and Technician Apprentice recruitment and training.

* * *

Correction

In the February, 1959, issue of this journal (page 59), we published a brief note relating to a new publication available from Babcock & Wilcox Limited, and describing the company's range of boiler cleaning tools. In the note, we referred to the publication reference number as "4MID58," whereas this should have been "1449/1."

NOTES Personal AND Industrial

Sir Gordon Russell, C.B.E., M.C., has decided to retire from the directorship of the Council of Industrial Design on December 31st, 1959. The Council has appointed **Mr. Paul Reilly,** who joined the staff in 1948, and has been deputy director since 1954, to succeed Sir Gordon Russell on January 1st, 1960.

* * *

Mr. H. R. Niven, M.A., C.A., and **Mr. H. N. Wilson,** F.C.C.S., A.M.B.I.M., have been appointed regional accountant and regional secretary, respectively, of the Midlands, and East Midlands Region of the Central Electricity Generating Board.

* * *

Mr. Ian Cameron has succeeded **Captain G. Villar,** C.B.E., R.N., (Ret'd.), as general manager of John I. Thornycroft's organisation at Southampton, which comprises shipbuilding, engineering and ship reparing, etc.

* * *

Mr. E. Forth, B.Sc.(Elec.), M.I.Mech.E., M. Inst.F., generation operation engineer, Central Electricity Generating Board, headquarters, has been appointed chief generation engineer, North East Division. Mr. Forth joined the North Eastern Electric Supply Co. as a student engineer in 1934 and was in the service of that company continuously until the reorganisation of the electricity supply industry in 1948, when he was superintendent at North Tees power station. He relinquished this post at Vesting Day to become generation engineer (operation) for the Southern Group, and subsequently for the Northern Group of the Authority's North Eastern Generation Division. In 1957, he became generation operation engineer, headquarters, the post he relinquishes to take up his new appointment.

* * *

Mr. W. Warren, M.B.E., M.I.Mech.E., M.I.E.E., generation engineer (operation), East Midlands Division, since 1948, has been appointed chief generation engineer in the division in succession to **Mr. O. S. Woods,** who is now divisional controller.

* * *

Mr. K. A. Robinson, of Lancashire Dynamo Electronic Products Ltd., has been promoted within the company to a new appointment as chief engineer. In this position he will be responsible for application engineering aspects of the operations of the company. **Mr. W. F. Hill** has been appointed chief development engineer with L.D.E.P., taking over the position formerly held by Mr. Robinson.

* * *

Metropolitan-Vickers Electrical Co. Ltd. announces the appointment of **Mr. H. West,** M.I.Mech.E., M.I.E.E., as assistant managing director. Mr. West has now ceased to act as director of electrical engineering.

Mr. R. D. Gardiner, formerly associated with the Industrial Group of the United Kingdom Atomic Energy Authority and responsible for contracts, purchases and control of stores, has been appointed assistant chief contracts officer of the Central Electricity Generating Board. **Mr. S. Swallow,** formerly chief contracts officer of the National Coal Board, has been appointed assistant chief purchasing officer of the Central Electricity Generating Board.

* * *

Dewrance & Co. Ltd. announce that **Mr. Andrew Brown,** formerly chief assistant to the company's sales manager, **Mr. B. S. Bass,** has been appointed assistant sales manager. Mr. Brown is closely associated with the sales of special valves designed for service in nuclear power plants.

* * *

Mr. R. E. Wilson, M.I.Mech.E., managing director since 1941 of Fescol Ltd. (London, N.7), retired recently after 30 years' service with the company. Succeeding Mr. Wilson as managing director is **Mr. F. B. Strachan,** who has been assistant managing director since 1951.

* * *

Dr. J. B. Mavor, who until his retirement three years ago was chairman of Mavor & Coulson Ltd., died on January 30th after a long illness. Dr. Mavor was born in 1889, educated at Glasgow Academy, and served an apprenticeship in engineering. In 1910, he joined Mavor & Coulson, in the contracts department. He became a director in 1920, and in 1923 took charge of design. In 1934 he became managing director and in 1946, chairman.

* * *

Mr. George A. Williamson, M.I.Mech.E., director of engineering of Firestone Tyre & Rubber Co. Ltd., Brentford, Middlesex, retired on January 30th, 1959. From 1913 to 1928 he was plant engineer with The British Thomson-Houston Co. Ltd., at Willesden. Mr. Williamson joined Firestone in February, 1928, as chief engineer, and was appointed director of engineering in 1953.

* * *

Mr. C. E. Akerhielm, A.M.I.E.E., has been appointed to the board of Ewbank & Partners. He was born in Stockholm and received his early education in Sweden, later attending Faraday House where he obtained an honours diploma. In 1940 he joined Crompton Parkinson Ltd., at Chelmsford, working in the short-circuit test laboratory and the switchgear design department. During the war he served as a captain in the R.E.M.E. in Europe and India. In 1947, Mr. Akerhielm joined the staff of A.S.E.A., Sweden, returning to join Ewbank & Partners in 1948 as assistant electrical contracts engineer—becoming senior contracts engineer in 1953.

Lord Mills, Minister of Power, will open the 1959 Factory Equipment Exhibition, to be held at Earls Court from April 7th-17th. The exhibition will be of direct interest to engineers in all types of industry. The latest methods of heating air-conditioning and ventilation will be shown, and a wide range of production equipment and devices for measurement, instrumentation and automatic control will be available for inspection.

* * *

The Hon. J. Kenneth Weir, C.B.E., chairman of G. & J. Weir Holdings Limited, and of G. & J. Weir Ltd., Cathcart, Glasgow, has been elected a director of The International Nickel Company of Canada Limited, and a member of its advisory committee. He fills the vacancy on the International Nickel board caused by the retirement of his father, **The Rt. Hon. Viscount Weir,** P.C., G.C.B., who had served as a director since 1928.

* * *

Prat-Daniels (Stroud) Ltd., Stroud, Glos., manufacturers of fans, grit-collectors and dust-collectors, advise us that they have moved from their London office at Westminster Palace Gardens, Victoria Street, S.W.1. The London office of the Daniels Group which includes T. H. & J. Daniels Ltd., is now situated at 62/3, Fenchurch Street, E.C.3. Tel.: Royal 4122/6305. **Mr. A. O. R. Johnson,** managing director of T. H. & J. Daniels Ltd., has joined the board of Prat-Daniels (Stroud) Ltd.

* * *

It is announced that the board of **Booker Brothers, McConnel & Co. Ltd.** (a member of the Booker Group of Companies), has purchased 90 per cent. of the issued share capital of **Sigmund Pumps Limited** from members of the Sigmund family, and from the **Industrial & Commercial Finance Corporation. Mr. Miroslav Sigmund,** the managing director of Sigmund Pumps Limited, retains a 10 per cent. interest in the company, and remains managing director. The present management of Sigmund Pumps Ltd. will continue as at present, at Team Valley, Gateshead.

* * *

Construction of the new research laboratory for the **Cambridge Instrument Co.** has commenced. The building, with a floor area of some 20,000 sq. ft., will provide an imposing frontage for the company's Cambridge factory. Design and drawing offices will occupy the top floor, while the three floors below, are to be fitted with the latest equipment for instrument work involving physics, chemistry, electronics and precision mechanical engineering. The new laboratory is scheduled for completion in June, 1959. Edward D. Mills and Partners are the architects, and J. Jarvis & Co. the main contractors.

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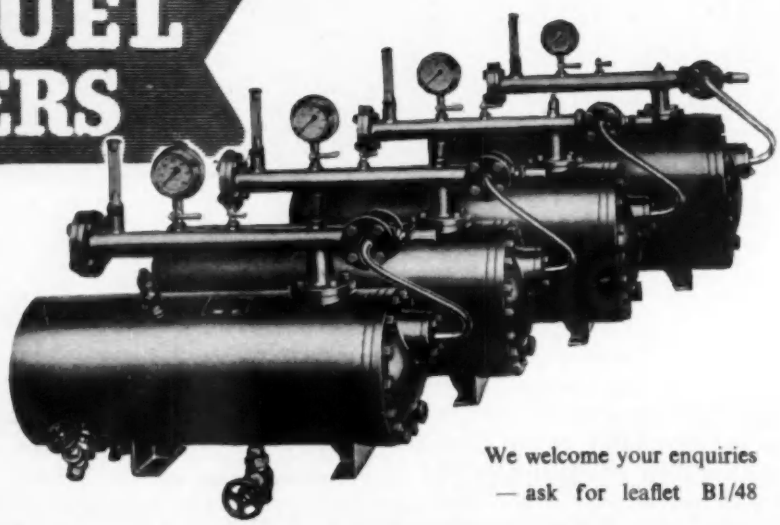

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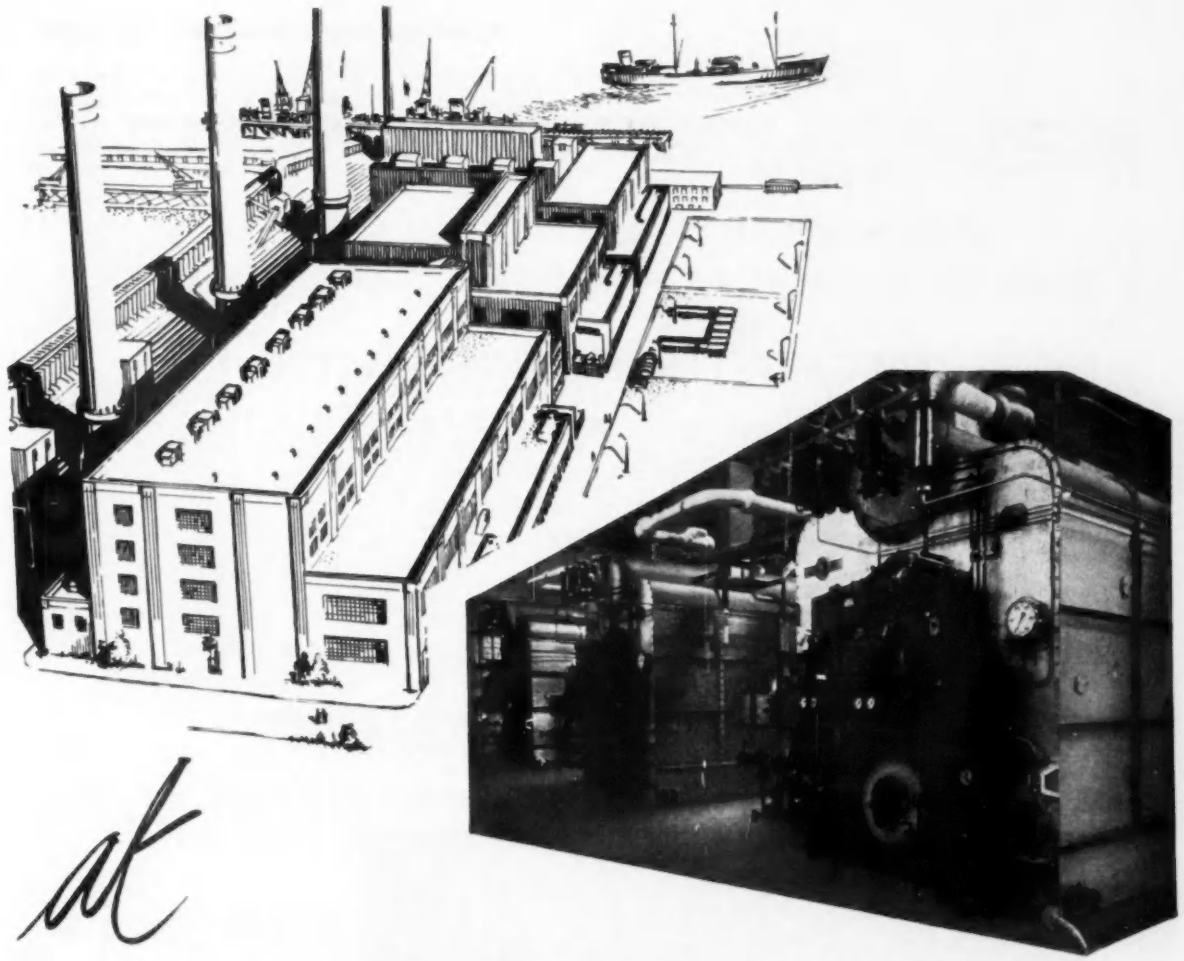

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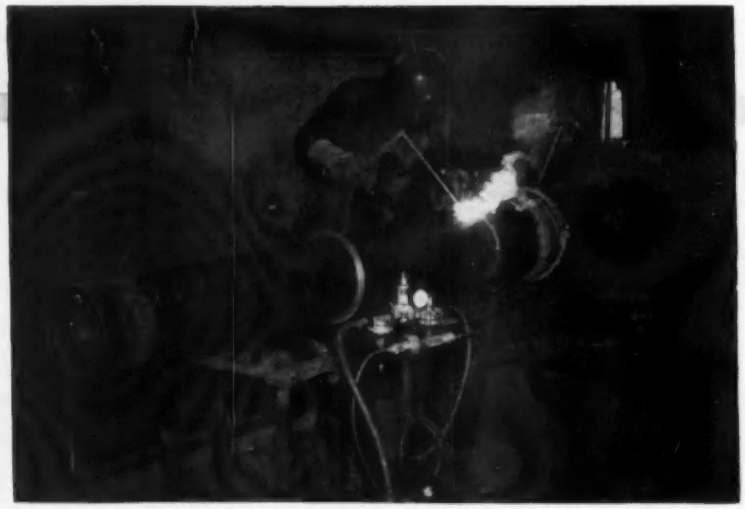

The Unit Superheater and Pipe Co. Ltd., following initial contracts for reactor charge tubes for Calder Hall and Chapelcross power stations, has been entrusted by Whessoe Limited, member company of the Nuclear Power Plant Co., to produce the charge/discharge and control rod stand tubes for Bradwell Power Station.

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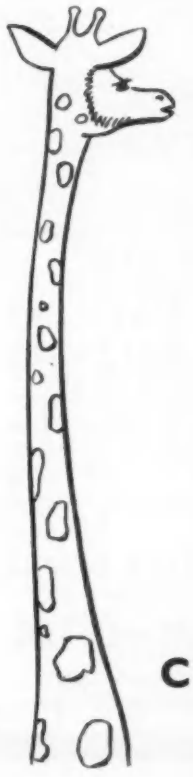

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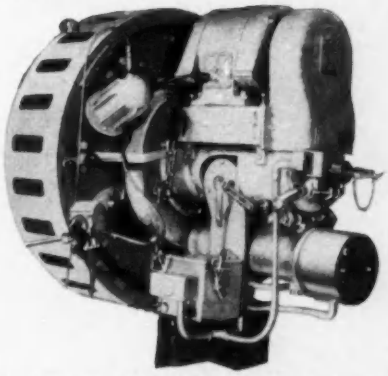

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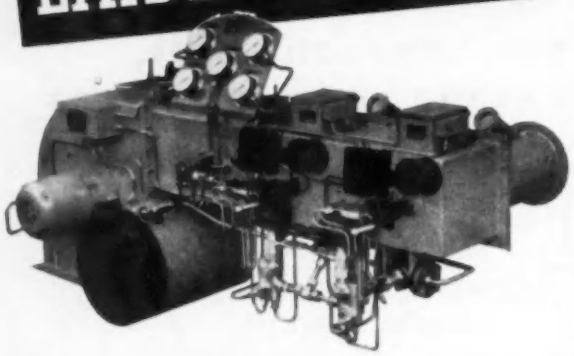

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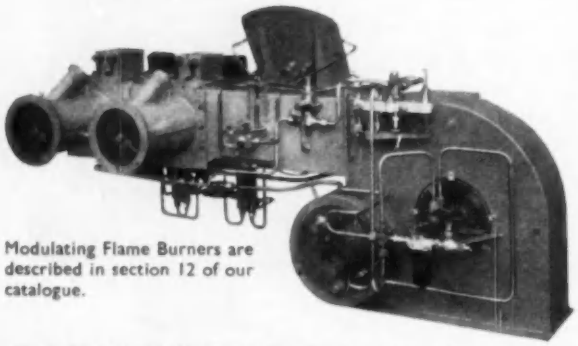

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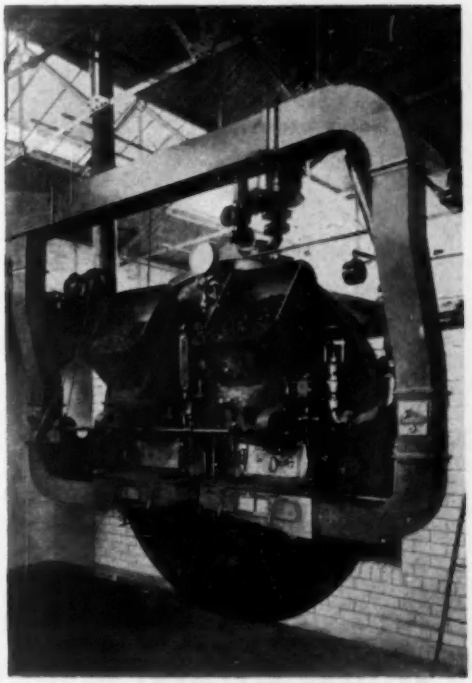

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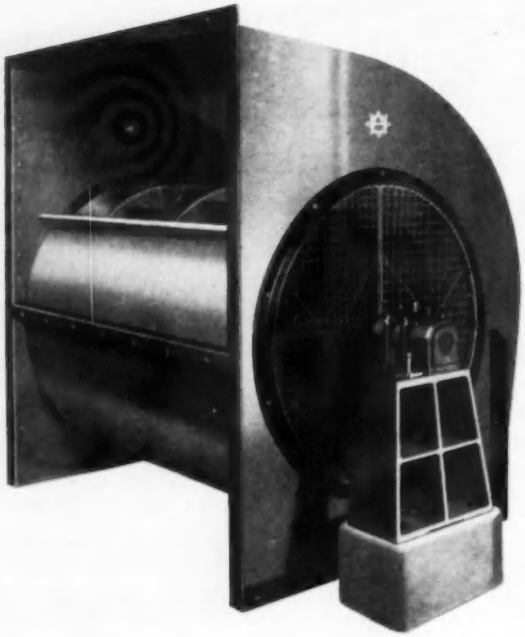

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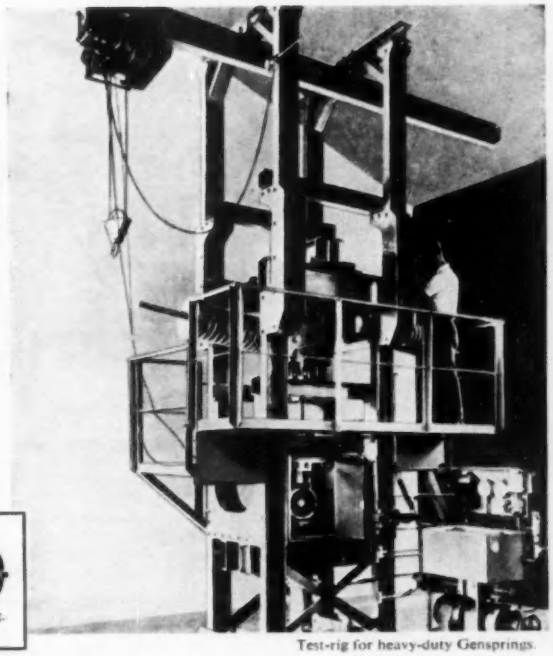

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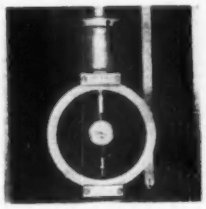

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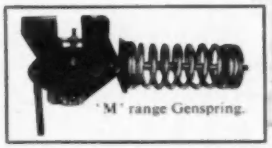

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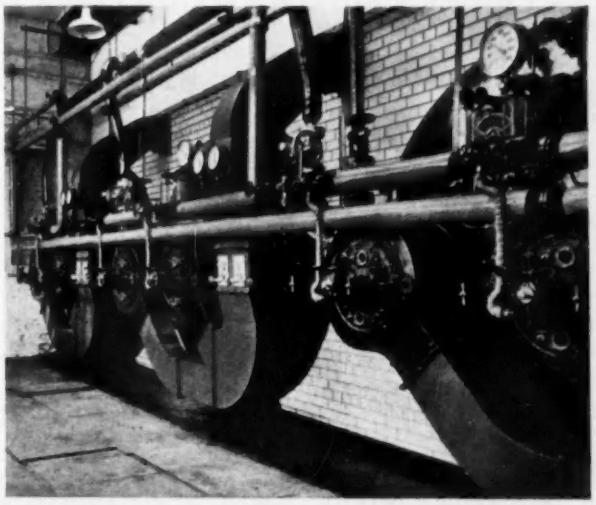

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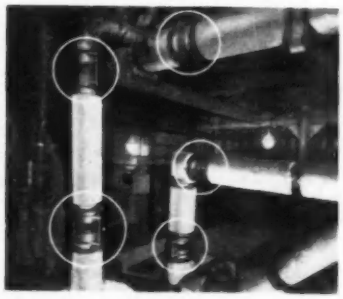

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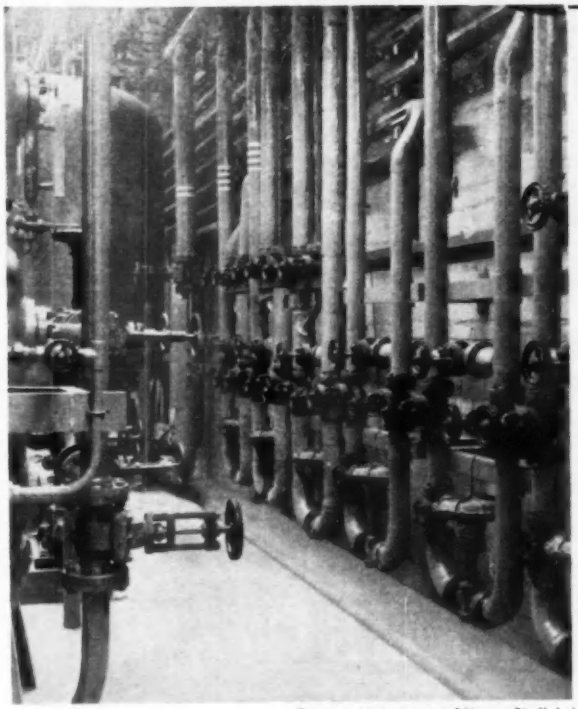

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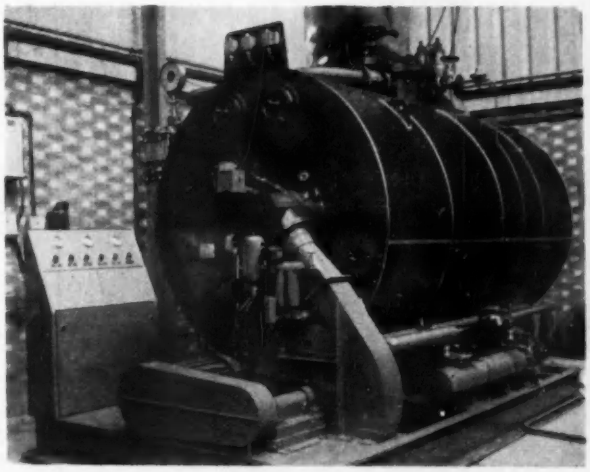

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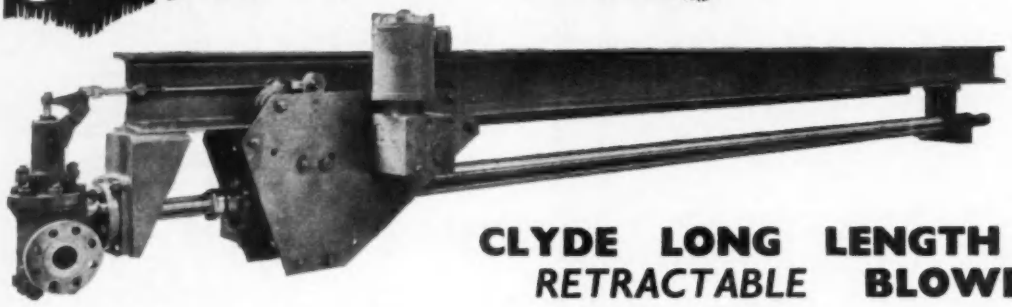

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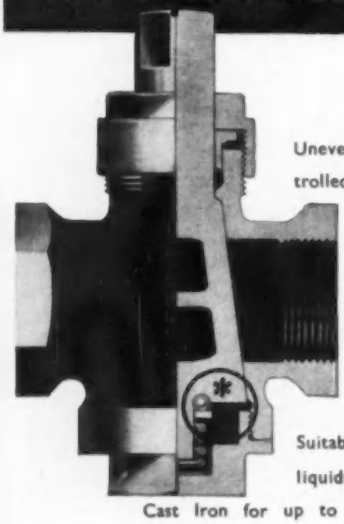

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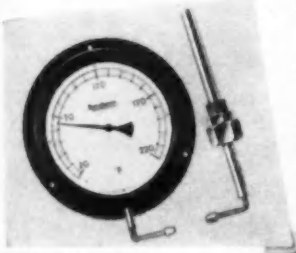

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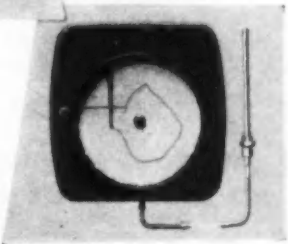

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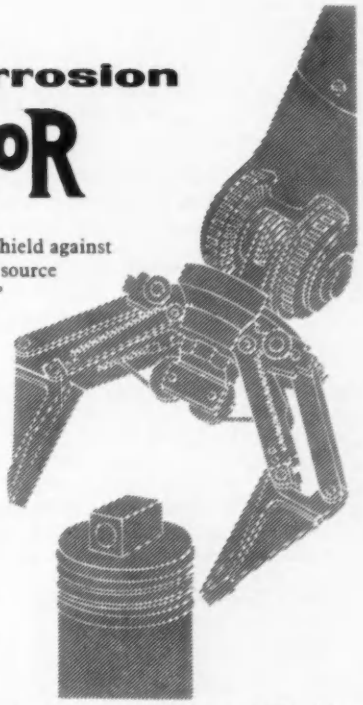

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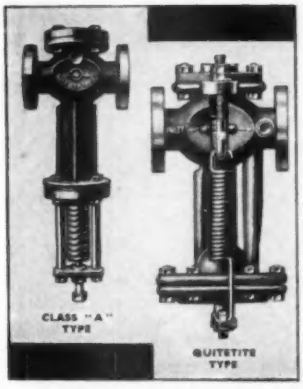

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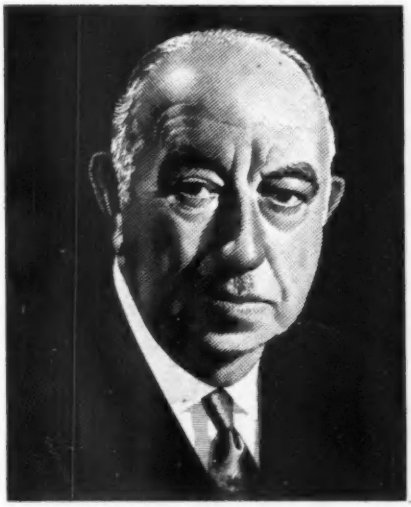

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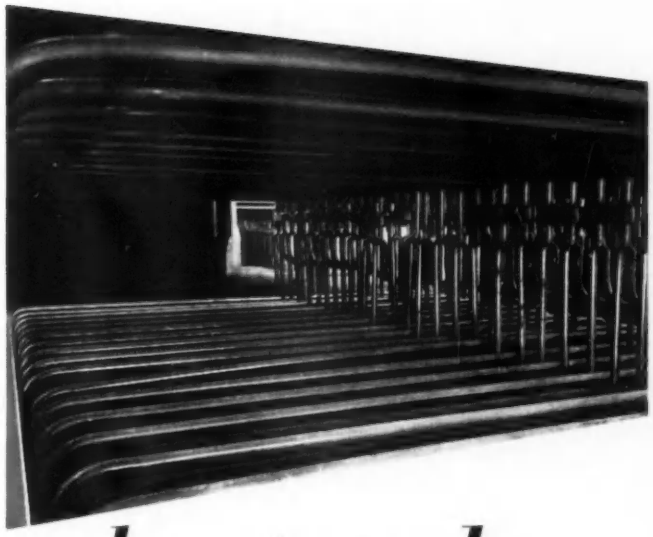
lbs of steam per hour at Superheat and Reheat temperatures above

1,000°F



THE SUPERHEATER CO. LTD.

97, TOTTENHAM COURT ROAD, LONDON W1

THE AUTHORITY ON SUPERHEATED STEAM

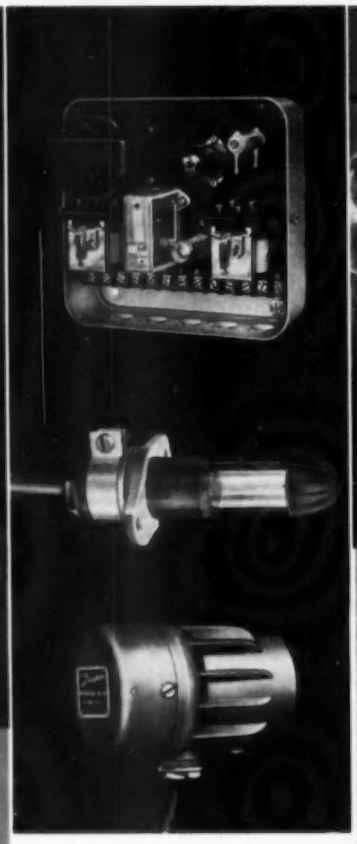
BLYTH · THORPE MARSH · BUENOS AIRES · VALES POINT · TALLAWARRA · WILLINGTON

The Danfoss combined control boxes with thermally operated flame control, are designed for fully automatic control of small oil burners.

Control boxes of the CBK type reduce attendance to a minimum since—in conjunction with the thermostats of the system—they ensure fully automatic operation, stopping and starting the burner according to the heat requirements. In the event of flame failure the plant will always be stopped immediately the failure occurs. After a re-cycle period, the length of which can be adjusted, the unit will automatically attempt to restart the burner. In the event of a continual fault the plant will be cut out entirely, a built-in signal lamp indicating the stoppage.

The Danfoss separate control boxes Types CBS with their thermally operated flame control, type FS, are built up of the same components and have exactly the same functional properties.

Both the combination control boxes and the separate ones are supplied in designs for "constant ignition" or "intermittent ignition."



The Danfoss control boxes with electronic amplifier for photo-electronic flame control react—in conjunction with the photo-cell—immediately a flame failure occurs and, due to their quick reaction in the event of flame failure, they are well suited to large as well as small oil burners.

The photo-electric flame control is supplied in two designs: Type PB for fitting in the blower pipe, which gives the simplest way of fitting and the best protected location, and Type PC for fitting on a light channel pipe if special conditions prevent the application of units of the PB type.

Fitters and service men know Danfoss and know that the Danfoss control boxes ensure them the minimum of service on burners which have already been installed and that gives them more time for new installations. They also prefer Danfoss because Danfoss supplies everything for oil burners (pumps, non-return valves, strainers, thermostats, shut-off valves, nozzles, ignition, electrodes, etc.) and therefore they only need to stock Danfoss spare parts. You should also "go over" to Danfoss.

We shall be pleased to send you our brochures about the whole of our programme for heating controls.

Danfoss

AUTOMATIC CONTROLS AND EQUIPMENT

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